

PUBLIC WORKS

June
1960

CITY, COUNTY AND STATE

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IN THIS ISSUE



John J. Sullivan is Superintendent of Streets and City Registrar of Dallas. In this position, he has been responsible for a major dollar program of improvements. See also page 18.

Wedge-Lock[®]

THE JOINT
with the

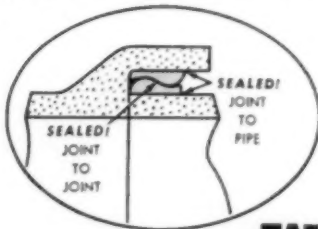
Full Circle

OF
PROTECTION

**MINIMUM
INFILTRATION!**

**ROOT-TIGHT
SEAL!**

FAST INSTALLATION!



When you install Vitrified Clay Pipe with Wedge-Lock Factory-Made Joints, you leave nothing to chance. Wedge-Lock pre-cast Joints are bonded to bell and spigot . . . snap together instantly . . . seal the entire circumference of the pipe to reduce infiltration and resist roots. Always specify Wedge-Lock, your Full Circle of Protection against infiltration . . . root problems . . . job delays . . . ultimate high cost resulting from costly repairs or maintenance.

Write to listed manufacturers for literature or an actual Wedge-Lock demonstration

Wedge-Lock CLAY PIPE

THE FACTORY-JOINTED CLAY PIPE AVAILABLE NATIONALLY FROM LOCAL MANUFACTURERS

Order Wedge-Lock from any of these Vitrified Clay Pipe Manufacturers:

Cannelton Sewer Pipe Company. Cannelton, Ind.
The Clay City Pipe Company. . . Uhrichsville, Ohio
Graff-Kittanning Clay Products. Worthington, Pa.
Larson Clay Pipe Company. Detroit, Mich.
Lehigh Sewer Pipe & Tile Co. Fort Dodge, Ia.

The Logan Clay Products Company. . Logan, Ohio
Owensboro Sewer Pipe Company. Owensboro, Ky.
Pomona Terra-Cotta Company. Greensboro, N. C.
The Robinson Clay Product Company. Akron, Ohio
Superior Clay Corporation. . . . Uhrichsville, Ohio

"Chicago"
from

The NEW

FLUSH KLEEN® System

TWO MAJOR DESIGN IMPROVEMENTS

1. NEW FLO-THRU STRAINER ... permits greater solids loading

2. NEW BY-PASS FITTINGS

(including special By-Pass Valve and separate By-Pass inlet line to wet well)

... allow greater inflow capacity

... permit pump selection based only on discharge capacity

PROVIDES THESE ADVANTAGES

- Lower original costs ... smaller pumps and motors required
- Pumps handle clear liquid only
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- Reduced maintenance
- 100% standby capacity
- Longer pump life

NEW ... Successfully handles high wet-strength paper products

NEW ... Successfully handles ground garbage

NEW ... Increases maximum solids loading capacity

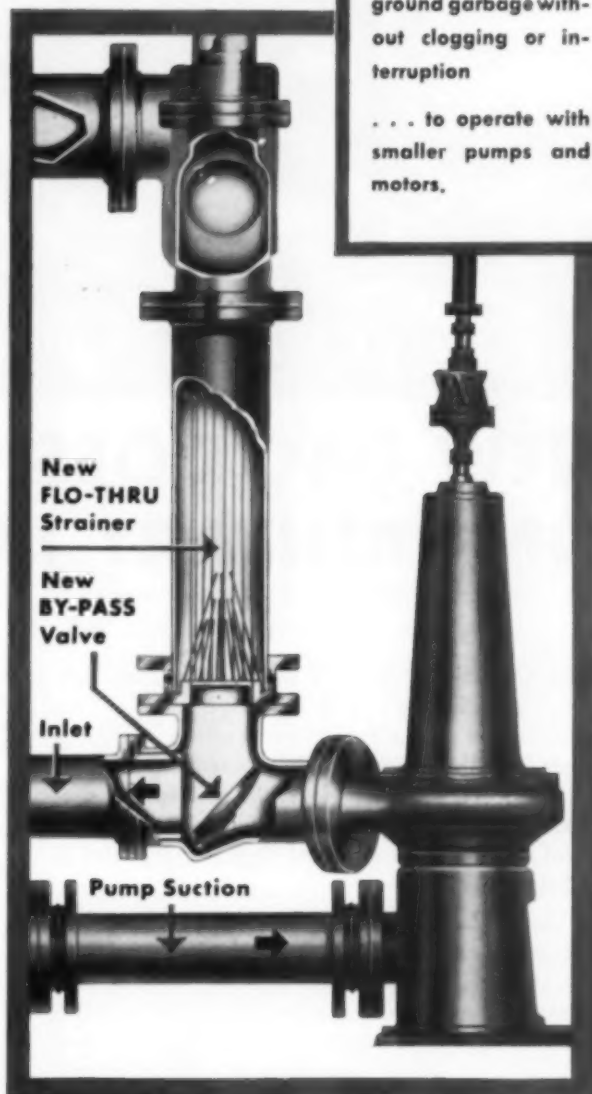
NEW ... Uses smaller pumps and motors

OVER 13,000 FLUSH KLEEN® INSTALLATIONS FOR:

Municipalities • Industrial and Commercial Buildings • Schools • Institutions • Hotels
• Hospitals • Motels • Auditoriums
• Subdivisions • Ships

Write for Bulletin No. 122-D

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COMPLETELY REDESIGNED

... to handle modern high solids loadings of wet-strength paper products and ground garbage without clogging or interruption

... to operate with smaller pumps and motors.

SOLIDS NEVER REACH THE IMPELLER



Putting Ideas to Work
FOOD MACHINERY AND CHEMICAL CORPORATION
HYDRODYNAMICS DIVISION

CHICAGO PUMP

622F DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

JACKSON, MICHIGAN



NEW D4C DOES "DOUBLE DUTY" ON SANITARY LANDFILL

A new D4 Series C Tractor is busy on a sanitary landfill operation for the City of Jackson, Michigan. This landfill covers eight acres and serves more than 75,000 people living in Jackson and the surrounding area. At the completion of the operation the area will be converted into recreational grounds for an intermediate school now under construction. Both are scheduled to be finished in 1961.

The D4C's first duty is to 'doze refuse into low areas, compact and cover it with earth. Its second duty is to excavate, transport and store cover material with a scraper. Haul distances range between 100 and 600 feet and the depth of the fill varies from five to 11 feet.

Behind the City of Jackson's decision to buy a new D4C were two factors: (1) successful experience with Caterpillar equipment and, (2) design features of the new Series C which met the city's requirements.

Today, when tax dollars must go further than ever, you can count on the new D4C to deliver high production at low costs with less maintenance and longer life. Some of the new features are listed to the right. For complete facts, see your Caterpillar Dealer.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

NEW INTEGRAL HYDRAULIC SYSTEM of the D4C does away with externally-mounted controls on front or rear of tractor — permits convenient routing of hydraulic lines to bulldozer or implement cylinders.

HIGH GROUND CLEARANCE — 14 inches — highest in class! This, coupled with clean design underside, speeds work over rutted or debris-strewn ground.

NEW 63 HP CAT D330 ENGINE — provides 25% more lugging ability at the drawbar. Plus improved starting engine for fast starts.

TIME AND COST SAVING MAINTENANCE FEATURES — New dry-type air cleaner keeps out 99.8% of the dirt under the most severe conditions; cuts maintenance time as much as 75%. . . . New lifetime lubricated track rollers with exclusive floating ring seals require no servicing. . . . Famed Cat fuel system is adjustment-free. . . . Oil clutch (optional) delivers up to 2000 hours' service without adjustment.

NEW COMFORT, CONVENIENCE, SAFETY — Clean open deck, convenient controls, forward-reverse lever (exclusive in D4C class) and comfort-contoured seat add up to top operator efficiency.

CATERPILLAR

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**BEST BUY FOR
YOUR TAX DOLLARS**

PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATE

JUNE, 1960 • Volume 91, Number 6

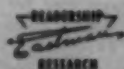
Sewage Treatment Plant to be Future Pump Station Plant serving a 311-acre corner of a 5,180-acre drainage pattern will be easily convertible to a lift station when population growth permits financing of ultimate plant. WILLIAM J. CHASE	83	Tracers for Circulation and Mixing in Natural Waters Sensitive tracers permit direct experiments on time and space distribution of materials introduced into natural bodies of water. J. H. CARPENTER	110
Watershed Forest Pays Its Way How the Manchester Water Dept. utilizes all the by-products from intensive forest management to pay for improvements. A. J. CHRISTIE	88	Conduit Problems of the Growing Community Conduit design problems grow with the community. Here is a guide for all concerned with the develop- ment of drainage facilities. R. J. FLETCHER	113
Sound Engineering and Planning Pay Off for an Airport Economies of farsighted engineering are demon- strated by Baltimore's Friendship Airport. J. E. LAIRD	90	A Study of Ground Water Quality and Contamina- tion Sources With only 5% of the homes of a populous county served by sewers there is good reason for ques- tioning ground water quality, especially where syn- dets are found in samples.	115
Pavement Edge Maintenance Corrective and preventive maintenance adds life to secondary roads in North Carolina. B. W. DAVIS	94	Planned Utility Program Attracts New Industry A master plan that provided adequate utilities is relieving the burden of high per-capita taxes typi- cal of a residential community. F. G. GOFF	118
Design and Construction of Small Dams The use of small earth dams in Midwestern states, and a discussion of design of embankments and spillicays. Typical examples are given. CARL A. ELSEA	95	Softening and Iron Removal Plant Designed for Low Cost Operation Attractive residence-type structure houses an auto- matic treatment plant. EDWARD B. SCHREINER	120
Mulching Seeded Areas Mulching materials, procedures and equipment used on roadsides in Ohio. W. J. GARMHAUSEN	100	Placing Concrete for the New Glen Canyon Dam	128
Simplified Sewer Design How a chart based on the Kutter diagram can be used for quick determination of pipe sizes required in storm and sanitary sewers. R. B. STEYTLER	102	Engineer and Contractor Cooperation	132
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Single Operation Paints Center and Edge Lines Pavement marking operation proves to be both practical and economical. B. H. BOWMAN	107	City Backs Bond Issue by Real Estate Venture 4200 acres of surplus property will be a "city within a city." C. E. WRIGHT	148
San Antonio Is Catching Up on Overdue Water Works Improvements A vast construction program is rejuvenating this water system which had suffered for 30 years from a restrictive financing agreement that curtailed improvements. R. A. THOMPSON	108	Bridge Repair Uses Special Epoxy Mortar	150
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THIS IS THE STATION THAT IS PREFABRICATED AND DELIVERED



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READY TO OPERATE

A PACKAGED UNIT—completely shop-fitted with quality components throughout. Transported to job site ready for installation.

SIMPLIFIES LOCATION—underground operation permits use of existing public property such as parkways, etc. Saves cost of surface property and enclosing structure.

ECONOMICAL—saves costs and time. Prefabrication results in lower construction costs and less time at job site. Simply set in place, connect and start up.

ZF

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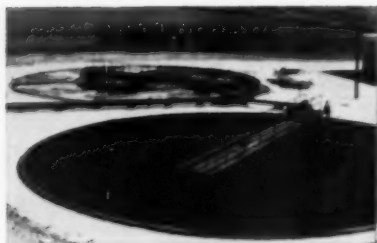
P.O. BOX 359, MOLINE, ILLINOIS

COMPLETE DATA, SPECIFICATIONS AND DRAWINGS AVAILABLE—WRITE

WALKER PROCESS

SPARJAIR COMPLETE SEWAGE TREATMENT PLANTS

Designs for all Developments and Land Planning Projects



Hampton Pk. (Hsg. Devel.), Ill.—1 mgd tot. cap.



Finn Trailer Ct., Ill. (365 units)—45,500 gpd.



Hillcrest Shpg. Ctr., Joliet, Ill.—50,000 gpd.

Sparjair units overcome previous objections to locating a plant near residences, shopping areas, schools, etc. Its new but proven principle of Contact Stabilization aerates and thoroughly oxidizes all odor producing wastes.

Nested design provides complete treatment equal to large municipal plants.

1. Permits development of outlying, low cost land.
2. Capacities from 50 to 5000 population equivalent.
3. Eliminates septic tanks and drain fields.
4. Virtually automatic—Simple operation.
5. Approved by Health Authorities.
6. Odor free — no septic or stale operations.

Details and layouts are available to Consulting Engineers and their Architects, concerned with the design of package sewage and water treatment plants. Write factory at P. O. Box 266, Aurora, Ill. for complete information.

Walker Process also offers CLARIPURE Package Water Purification Plants—pre-designed capacities from 50 to 600 gpm.

WALKER PROCESS EQUIPMENT INC.

FACTORY & ENGINEERING OFFICES
LABORATORIES

AURORA, ILLINOIS



The Government's Problem of Getting and Keeping Engineers and Scientists

IN RECRUITING and retaining the kind of engineering and scientific skills needed, the government faces a difficult problem. Data show that salaries for such personnel have lagged behind industry, and the spread is probably increasing. Recently the NSPE has made five suggestions, some of which are sound, though others appear difficult or unworkable. Two excellent ones recommend establishment of procedures for quick adjustment of salaries as non-governmental rates for comparable employees change; and provision for recognizing outstanding merit, ability, job performance and responsibility by salary adjustment instead of by promotion. Yet these will be difficult because they tend to add very complicating factors to a system not designed for consideration of the need for individuals.

In the meantime let us not forget the thousands of high-type engineers in cities, counties and states. It seems to us that they need just as much consideration, help and encouragement toward better salaries as any other group.

Sanitary Engineers, Sanitarians and Public Health Departments

A FEW YEARS ago in order to up-grade sanitary engineers and perhaps to simplify organization, there was a tendency to create environmental sanitation divisions in health departments and to place engineers at the tops of these. At the state level, this works pretty well because few state health departments employ sanitarians in connection with their engineering work. At the county and city level, the situation is something else again. If environmental sanitation is required to be headed by an engineer, as is usually the case, no sanitarian, no matter how able, can expect to attain any position of responsibility or any fair pay status. The result can be an increasing shortage of capable sanitarians who, in many respects, are the work horses of local environmental health operations.

Some few years ago, when engineers were in very short supply, some state highway departments tried bringing non-engineers into their engineering departments to do some of the lower-level work, such

as surveys and computations. Not so much has been heard of this lately.

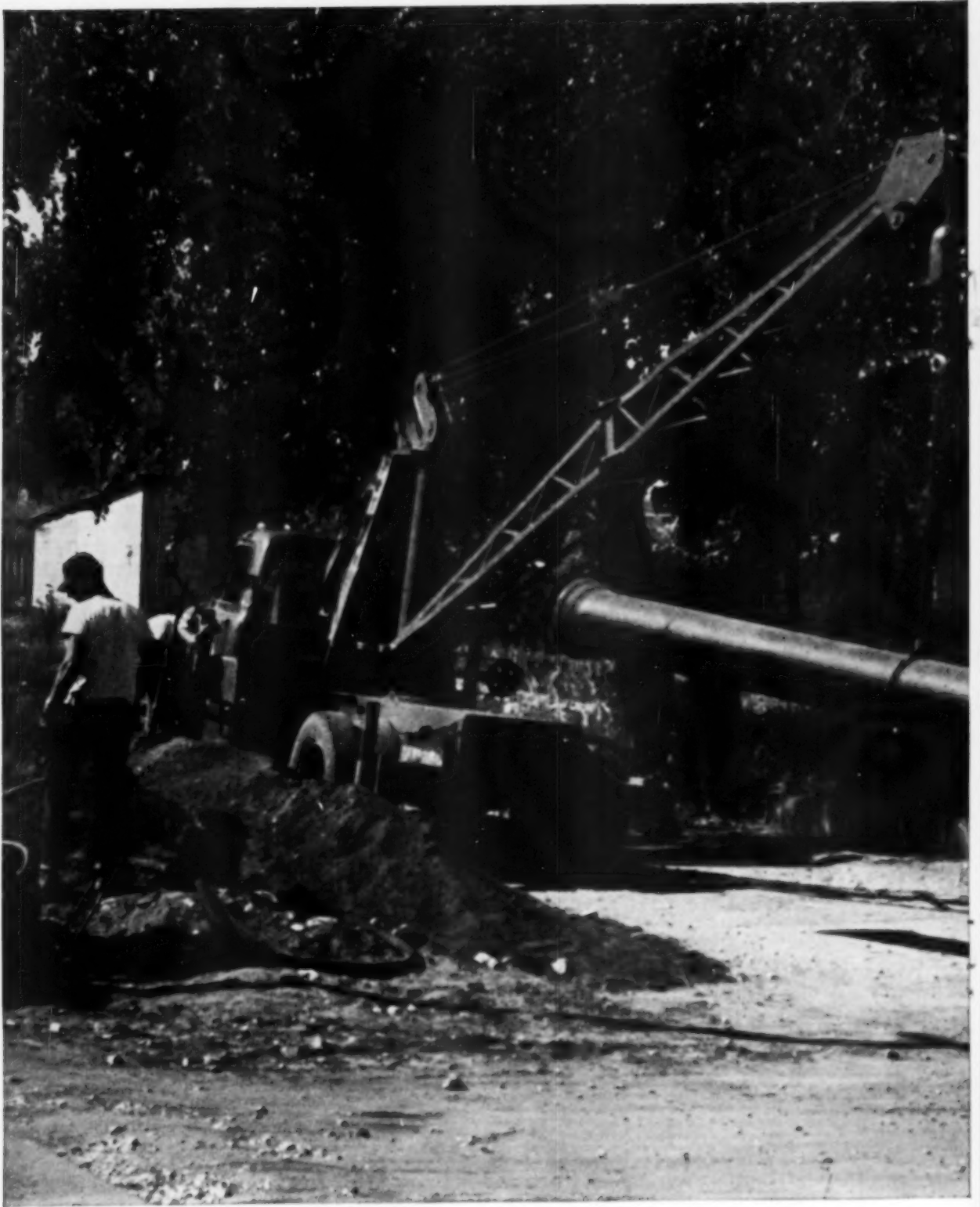
The proper use of non-engineers in an engineering group is difficult. Provision must be made to permit advancement based on ability. This means that a new type of organization must be developed in local health and possibly in state and other public works engineering staffs. A division of inspection, or of surveys or of some similar nature may be an answer. Anyway this is a problem that needs research and study to develop a solution fair to all concerned.

The Women May Take Over

ANY MARRIED reader will recall how far he ever got with telling a woman that he could not afford what she believed the health and well-being of her family required. Only a micrometer could measure the gain. A new and irresistible force is being added to the pressure for more and more adequate treatment of sewage and industrial wastes to stop water pollution. Already this year three major general magazines with readerships of many millions each have run a spate of articles alerting the country to what they term the dangers of such pollution. The women's organizations are entering the fray with a certain fire in their collective eyes, and we are going to hear a lot more about this shortly. As to whether we can afford the vastly larger program, the question put to local governments will be: Can we afford not to? Certainly there is enough of waste, enough of frills in governments now to cover the cost of treating all the other wastes that our cities and industries contribute to our waters!

Sewage Disposal by Private Enterprise

A LAW HAS been passed by New York State which authorizes private corporations to construct and operate sewerage systems and disposal plants. This is an advance in the fight for pollution control for it permits leasing of a treatment plant by a community or its financing by service charges, just as a private water system is financed. There has been opposition in the past to private ownership but we think corporations will be less difficult to control than some municipalities have been and they may also provide a better degree of operation.





GOES TO BED WITH ITS WORKING CLOTHES ON

From the moment it is installed, cast iron pipe begins working—will deliver its full flow of water for over a century.

Here in Kansas, as part of a major water expansion program, 15,000 feet of cast iron pipe were put to bed. Ease of assembly, bottle-tight joints, and assured full-flow capacity through cement lining were important factors in the selection of cast iron pipe.

An interesting feature was the uncovering of distribution mains constructed of cast iron pipe manufactured in 1887. The pipe was in excellent condition and was put back in water service.

Cast iron pipe is always working. In fact, once it is installed, one can generally anticipate no major repairs or replacements for at least a century.

CAST IRON PIPE RESEARCH ASSOCIATION,
Thos. F. Wolfe, Managing Director,
3440 Prudential Plaza, Chicago 1, Illinois



CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE

Insist on the dependable operation of...

MUELLER FIRE HYDRANTS



**AWWA
Improved
Post Type**
4 1/4", 4 1/2",
5 1/4", 6 1/4"
Valve Opening
Two or Three
Way

**AWWA
Standard
Flush Type**
4 1/4" or 5 1/4"
Valve Opening
Two or Three
Way

Post Type
2 1/2" Valve
Opening One
or Two Way

Flush Type
2 1/2" Valve
Opening
One Way

■ Just one fire hydrant that does not function when needed will disrupt your entire fire protection network.

One way to assure the dependable operation of every hydrant in your system is to insist upon an effective hydrant inspection, maintenance and replacement program. With such a program, valuable time is not lost connecting and disconnecting hose to an inoperable hydrant.

To be doubly sure that each hydrant will work every time it is needed, insist on precision-engineered Mueller Fire Hydrants — quality hydrants with dependability "designed-in".

Compression-type main valves, automatically-force-flushed drain valve mechanisms and "O" ring

stem seal are just a few of the quality features found in all Mueller Fire Hydrants. These features are typical of the great attention to detail in research, design and engineering that becomes a part of every Mueller product.

The hydrants shown here are just a part of the full line of fire hydrants produced by Mueller Co. for municipal, industrial and private fire protection systems.

Write for complete information and specifications.

*Full line of inlets available
for all hydrants*



**MUELLER CO.
DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles
In Canada: Mueller, Limited; Sarnia, Ontario

1960 SPECIFICATIONS for your files



FOX Mountable Materials Spreader

for sand • cinders • chips • salt • calcium chloride



MOUNTING

On or off any standard dump body in only 15 minutes. T-head fasteners, cranks and base adjustment channels make this possible. Truck is quickly freed for other work.



LOADING

Sturdy $\frac{1}{2}$ " rods make up cover grids that break up lumps. Allow only spreadable material to pass through. Increases spreading efficiency and prevents damage to mechanism.



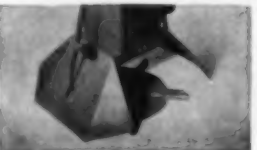
DASH-MOUNTED CONTROLS

Fingertip control from inside cab makes operation a one-man job. Panel includes—spreader engine ignition and starter switches, volume regulation control and electric clutch switch. Sanding at speeds up to 40 MPH.



FEED AUGER

Heavy-duty feed auger eliminates feed aprons and chains, the source of most frequent breakdowns. Auger mounted on 4 Timken tapered roller bearings, completely shielded from abrasives.



SPINNER

Adjustable for 8 to 40 foot spreading widths. Works close to ground—spreads under parked and passing cars . . . ahead and beneath rear truck wheels for added traction.

GENERAL SPECIFICATIONS

Model	Box Length	Box Width	Weight Empty	Capacity Heaped* (yards)
8SS7	8'	80"	2435	5
9SS7	9'	80"	2610	5 $\frac{3}{4}$
10SS7	10'	80"	2849	6 $\frac{1}{4}$
12SS7	12'	80"	3156	8

*4", 6" and 12" height additions to box increases capacity—up to 12 cu. yds. on Model 12SS7.

ENGINE

—Wisconsin air-cooled, 18 H.P. @ 3500 r.p.m. with starter, generator and enclosed drive reduction.

BODY

—10 gauge prime steel. All welded construction with reinforcing ribs.

BEARINGS

—10 Timken tapered roller bearings and two sealed ball bearings plus engine bearings.

AUGER

—Mounted in two pillow blocks outside of the box, each with two Timken Bearings, fully shielded, mounted on a sleeve with an internal spline.

CONTROLS

—Manual controls outside driver's window, standard. Optional electric remote control panel on truck dash.

SPINNER

—18" diameter. Height adjustable by 4 position lever for 8 to 40' spread.

MOUNTING

—Quickly attached without drilling holes or welding.

GRIDS

— $\frac{1}{2}$ " rods on 3" centers, 4' and 5' sections.

SPECIAL USES

—Ideal as Seal-caster for summer road work. Special attachment converts unit to a Trench Filter.

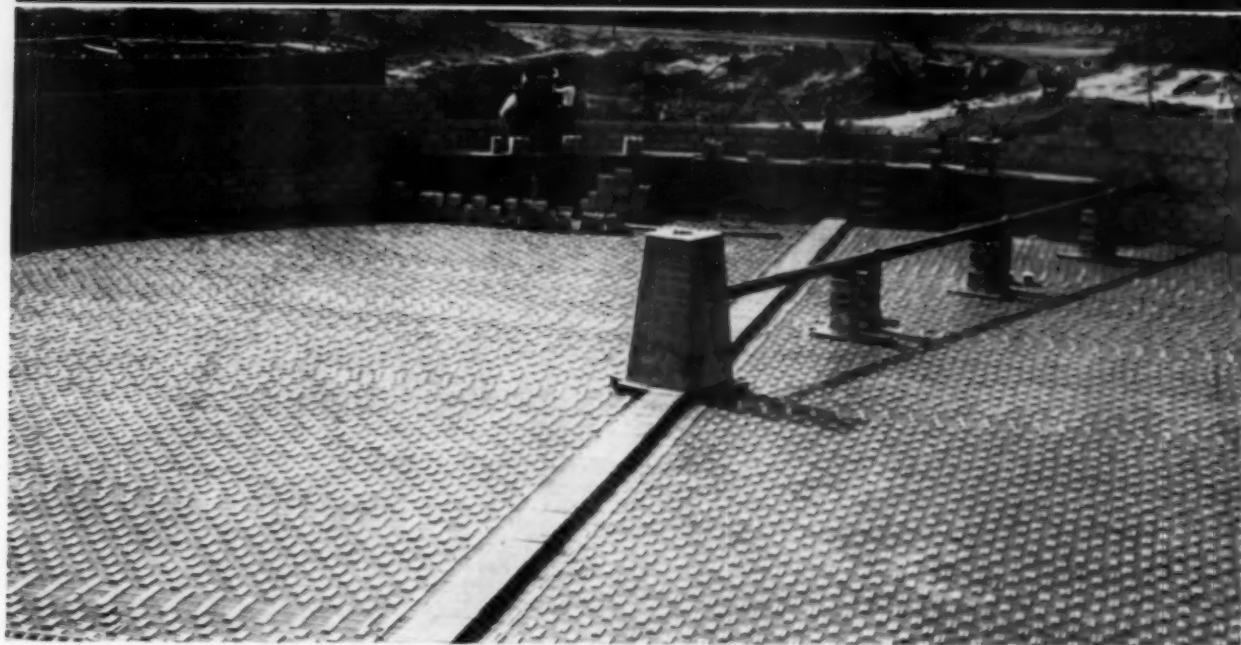
The Fox Materials Spreader will cut your labor, time and equipment expenses to the bone. A catalog . . . case history reports . . . even a no-obligation demonstration are yours for the asking. Write, call or wire collect for the name of the nearest Fox distributor, who will gladly give you a demonstration.

FOX RIVER TRACTOR COMPANY Road Machinery Division

1020 N. Rankin St. • Appleton, Wisconsin
Phone—REgent 4-1451

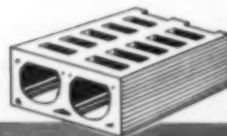
Q: Want new industries?

A: Offer clean waters!



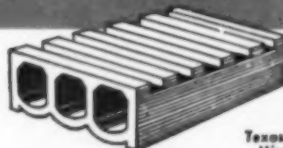
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NOW READY**

Mr. City Engineer and Mr. Consultant . . .
If you haven't already received
your free copy of the new data-filled
Handbook of Trickling Filter Design,
which contains latest
ASTM Specifications for
vitrified clay underdrain blocks,
write for a copy now.
Send your request to the
nearest member firm listed at right.



BOSCO
Bowerston Shale Co.
Bowerston, Ohio

TFFI Trickling



TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas



Unpolluted water in ample supply is a powerful competitive factor in bringing new industries to a community. Trickling filters in sewage and wastes treatment plants have become the preferred type for cleaning up our waters. Between 1945 and 1957, 926 trickling filters were built and construction of them has continued since at an unabated pace.

The most vital part of a trickling filter is its underdrain system. When it is of TFFI Specification vitrified clay blocks as pictured at the left, life-time trouble-free service is assured. It is inherent in clay alone to resist successfully the ravages of acids, alkalis and bacteriological action. TFFI blocks are made in modern plants under rigid controls of quality that no substitute materials can even approach. (*Only with TFFI blocks do you get a 50-Year Guarantee.*)

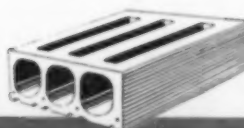
THE TFFI CONTRIBUTION TO CLEAN WATER



35% or more of America's population is now served by over 2,700 sewage works with trickling filters —most of them guaranteed a long and satisfactory life by use of vitrified clay underdrains.

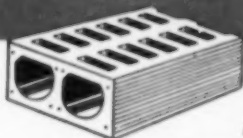


DICKEY
W. S. Dickey Clay Mfg. Co.
Kansas City 8, Mo.

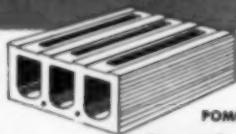


NATCO
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327 Fifth Ave.
Natco Corporation

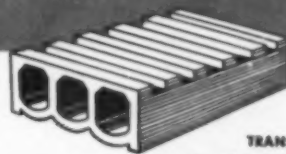
Filter Floor Institute



ARMCRE
Ayer-McCord Clay Co., Inc.
Brazil, Ind.



POMONA
Pomona Terra-Cotta Co.
Greensboro, No. Car.



TRANSLOY
Connellton Sewer Pipe Co.
Connellton, Ind.

BEST TRACK... BIGGEST SAVINGS

Allis-Chalmers boosts work hours, cuts costs with the best tractor undercarriage in the business. You get industry's toughest track...best designed track guards...certified, permanently lubricated truck wheels, idlers, support rollers.

Next time you watch track shoes squeal and grind against jagged rock . . . or see 'em buried sprocket-deep in mud, consider this: Nothing slugs it out with tough conditions like an Allis-Chalmers tractor undercarriage.

Specially heat-treated track shoes, side bars, track pins and bushings are the industry's toughest. Bushings extend into counterbored side bars to seal out dirt, provide more bearing area.

Track guiding truck wheel guards provide a deep-flanged guide channel that keeps track riding true on sprockets, idlers and truck wheels even in the roughest and toughest going. The solid A-frame holds the truck frames in absolute alignment — keeps track running straight.

PERMA-SAFE truck wheels, idlers and support rollers on all Allis-Chalmers tractors roll on tapered roller bearings, are protected against dirt and moisture by Positive Seals. Factory-lubricated, they're certified never to need further greasing.

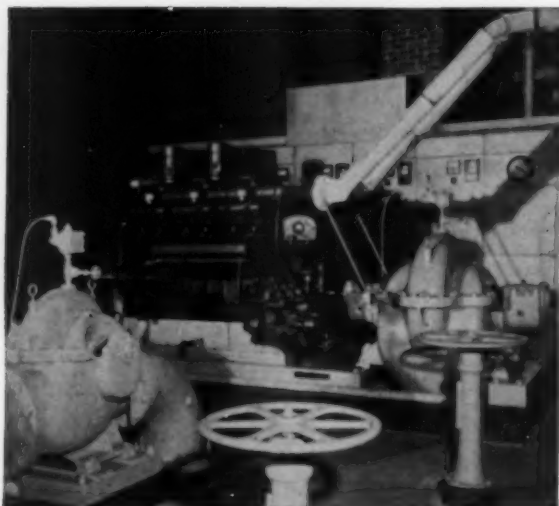
We invite a maintenance cost comparison with any other tractor undercarriage. We further invite you to inspect the Allis-Chalmers healthy, long-lived tractor engine, the all-steel main frame, double-reduction final drives and many other cost-cutting features. Your Allis-Chalmers dealer will be happy to give you full details. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.



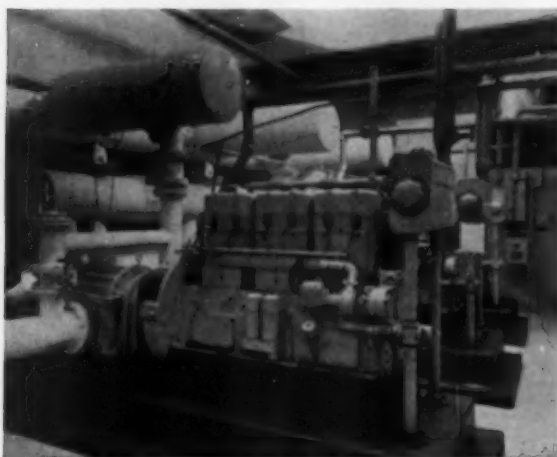
move ahead with
ALLIS-CHALMERS
power for a growing world







EAST—North Stamford, Connecticut—water pumping system.

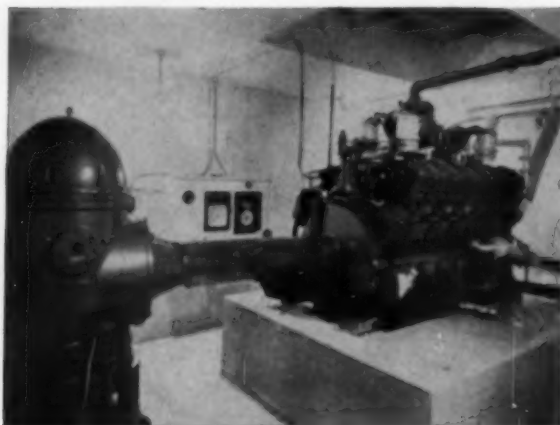


MID-CENTRIST—Waste disposal power in Enid, Oklahoma.



ROILINE
ENGINES

All over the country, municipal and utility plants use ROILINE engines in water supply systems, waste disposal services, and for power generation. Operating on natural or LP gas, or gasoline, ROILINES have been standard in the field for many years.



WEST—Rivera, California—deep well pumping power.

NATURAL GAS RATINGS					600	800	1000	1200	1400	1600	1800	2000	2200	2400
MODEL	Bore & S.	Cyls.	Displ.	Torque-rpm	BRAKE HORSEPOWER AT ENGINE SPEEDS INDICATED									
H570	4 3/8 x 4 1/4	8	570	457-1400	...	68	86	104	122	139	156	172	188	198
H884	5 3/8 x 4 3/8	8	884	710-1400	...	105	133	162	189	216	241	261	273	282
F1500	6 3/4 x 7	6	1503	1090- 600	125	165	200	215						
H2000	6 3/4 x 7	8	2004	1490- 650	170	225	270	290						
L3000	6 3/4 x 7	12	3006	2200- 700	250	335	405	435						
L3460	7 1/4 x 7	12	3468	2500- 900	285	380	474	555	592 @ 1350					
L4000	7.54 x 7.5	12	4000	3020- 600	345	447	550	635						

With oil pump, water pump, magneto, air cleaner, carburetor, and exhaust muffler. Hp shown is maximum.

Send for literature • SEE YOUR ROILINE ENGINE DISTRIBUTOR

ARIZONA, Casa Grande, Engine Service Company, Inc.
ARKANSAS, Paragould, Wonder State Manufacturing Co.
CALIFORNIA, Long Beach and Bakersfield
Engine & Equipment Company
COLORADO, Denver, Emrick & Hill Engine & Equipmt. Co.
KANSAS, Garden City and Great Bend
Carson Machine & Supply Co.
LOUISIANA, New Orleans, Southern Engine & Pump Co.

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NEW YORK, Syracuse, Schenckelady and Lisbon
J. C. Georg Corporation
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PENNSYLVANIA, Pittsburgh, P. C. McKenzie Company
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TEXAS, Houston, Dallas, San Antonio, Kilgore, Edinburg,
Corpus Christi, Beaumont
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Lubbock, Farmers Supply
Odessa, General Machine & Supply, Inc.
Wichita Falls, Nortex Engine & Equipment Co.
WYOMING, Casper, Emrick & Hill Engine & Equipmt. Co.

471-R

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN

New York • Tulsa • Los Angeles
Factories: Waukesha, Wisconsin and Clinton, Iowa

PUBLIC WORKS for June, 1960



DELAWARE COUNTY, OHIO, keeps its Huber-Warco 10-ton 3-wheel roller on a busy schedule of construction and surface tieing work. One of the roads recently rebuilt by the county received a surface course of asphalt and #6 chips compacted by the 3-wheel roller. Fast rolling speed kept the fleet of county trucks busy.



HUBER-WARCO

3 wheel rollers

SIZES FROM 10 to 14 TON

Huber-Warco 3-wheel rollers are made in General Purpose, Finishing, and Variable Weight models to fit every 3-wheel roller need.

TORQUE CONVERTER tailshaft governor and two speed transmission are standard. Doubles available power, cuts fuel costs, increases life of machine components one-third to one-half.

SPECIAL SUB FRAME suspended at three points carries engine and transmission assembly

and cushions outside shocks to increase machinery life.

GUIDE ROLL assembly has tapered roller bearings and is completely adjustable. Retains factory new adjustment indefinitely. Kingpin housing is removable.

OTHER FEATURES include replaceable tire design, differential lock, variable speed hydraulic steering, pressure sprinkling system, choice of gasoline or diesel engines.

A trusted product name backed by respected distributor names from coast to coast



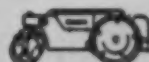
MOTOR GRADERS

Standard transmission models from 83 to 160 H.P.
Torque converter and power shift transmission models from 102 to 193 H.P.



TANDEM ROLLERS

3-5 Ton • 4-6 Ton
Retractable • 5-8 Ton • 8-10 Ton • 8-12 Ton • 10-14 Ton



3-WHEEL ROLLERS

10-Ton • 12-Ton • 14-Ton Standard Weight
10-12 Ton • 12-14 Ton Variable Weight



MAINTAINER

M-52 — 45½ H.P.
Attachments are Lift-Loader, Broom, Bulldozer, Patch Roller, Scarifier, Snow Plow, Berm Leveler

HUBER-WARCO COMPANY

Marion, Ohio, U.S.A.

Summer...

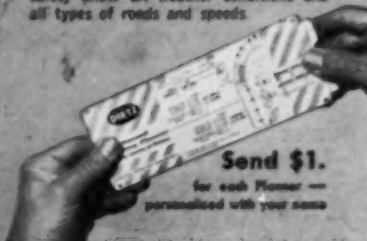
*now is the time to properly
light your construction hazards*

**It's Summer... more
highway projects...
more traffic, too!**

Whatever the season, where-
ever the road... it's always
the right time to adequately
light your highway hazards.
Protect the public and you
protect yourself.

NEW! DIETZ HAZARD WARNING PLANNER

A Practical On-the-Job Tool! Quickly and
easily shows how, when, and where to use
each type of warning light for maximum
safety under all weather conditions and
all types of roads and speeds.



Send \$1.

for each Planner —
personalized with your name

R. E. DIETZ COMPANY

Dept. 106, 225 William St. Syracuse, N.Y.

USE THE

DIETZ

3

WAY

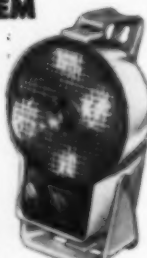
**HAZARD WARNING
SYSTEM**



LANTERNS



TORCHES



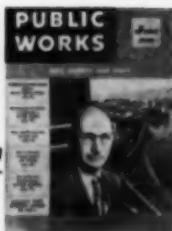
VISI-FLASH

Use Dietz Visi-Flash Lights to alert the on-
coming driver. Brightest, safest, most
trouble-free flashers on the market. Warn:
"Danger Ahead" for up to 1500 hours
without changing batteries.

Use Dietz Lanterns to locate hazard in re-
lation to driver's position. Show exact lo-
cation, shape, extent, and boundaries of
hazard area. Burn up to 100 hours.

Use Dietz Torches to guide driver around the
hazard. Fully illuminate the danger in
every weather. Burn up to 48 hours on
low cost kerosene.


Go DIETZ
and you go Safely



John A. Morin is Superintendent of Streets and City Engineer of Oakland, California, a position he has held since 1953. A graduate engineer, he entered this position with a broad background of engineering experience which included major highway, railroad and irrigation work. He served in the Army Corps of Engineers during World War II, with the rank of Lt. Colonel.

In regard to his work he says: "I have always been intrigued by the challenge offered to engineers in the municipal field. The opportunity to serve 409,000 'bosses' and explaining to them the technical features of public works is not present in other fields. Long an advocate that the latest techniques involving engineering skill and equipment, together with management skills employed in private industry can be used in governmental work, we have adopted similar policies and are gratified with the results." The results of these policies are readily evident in Oakland where \$22 million dollars of new construction of major streets, sanitary sewer facilities and storm drains, including a 4800-hp storm water pumping plant, has been completed during the last seven years. Traffic bottlenecks have been removed and areas formerly without drainage or sewerage facilities have been made available for industrial, commercial and residential development.

Active in many local civic and fraternal organizations, Mr. Morin is currently Director for the Western Area of the APWA and Director of the Municipal and Airport Division of the ARBA. He was appointed by the California Legislature as a member of the Highway Advisory Board to help develop the recently adopted California Freeway System. He is serving as a member of the Advisory Board now aiding in the development of a state-wide system of primary and collector arterials in cities and counties to supplement the Freeway System. He was awarded his City's "Good Government Award" in 1957.



New
Chicago
movable bridge
first with
Westinghouse
a-c static control

YOU CAN BE SURE... IF IT'S **Westinghouse**

COVER PHOTO: View at West Van Buren Street Bridge, Chicago, showing leaf rack, pinion and main drive gearing operated by Westinghouse Bridg-O-Matic control to raise and lower east leaf of bridge.



Double leaf, trunnion bascule bridge opening for Chicago River traffic. One man in operator's room, East Pier, upper right, controls the bridge by means of an all a-c system employing Westinghouse saturable reactor-type controller.

J-94132-2



W. C. Carl, Construction Engineer, Westinghouse (standing), discusses Bridg-O-Matic drive with Stephen J. Michuda, Chief Bridge Engineer, City of Chicago, at right, and his staff (left to right): S. Frayer, Structural Engineer; M. D. Krausman, Assistant Chief Bridge Engineer; and R. H. Keil, Electrical Engineer, Bridge Division.



Stephen J. Michuda; M. B. Trimble, Construction Sales Engineer, Westinghouse; and William G. Divane, President, Divane Brothers Electric Company, Electrical Contractors, discuss main control desk which centralizes operation of leaf and auxiliary drives and selection of east and west incoming service feeders. Instruments on sloped panel indicate leaf position and electrical circuit conditions.



View of switchboard room showing incoming line switching equipment, magnetic control for auxiliary drives, Bridg-O-Matic wound rotor motor control panels and saturable reactor cubicles. Robert E. O'Brien, Chief Electrician, examines panel containing emergency control switching equipment at far end of room.

Westinghouse Bridg-O-Matic Control specified to operate Chicago's West Van Buren Street Bridge

An important factor in the design of the West Van Buren Street movable bridge in Chicago was the selection of the most efficient drive and control system available. Westinghouse Bridg-O-Matic* control was specified after a study of its advantages over other types of control.

The West Van Buren Street Bridge is a double leaf, trunnion bascule bridge across the south branch of the Chicago River and is designed to carry vehicular and pedestrian loads. Each bridge leaf is normally operated by two 100-hp a-c wound rotor induction motors. For emergency operation, a single motor per leaf may be used. During normal operation, the time required to open or close the bridge is approximately 55 seconds. Four electrically operated thruster brakes are provided for holding each leaf in the desired position. Minimum brake shoe lining wear is encountered since the leaves are normally retarded by the motors through the action of the static reactor/Magamp controller to a low speed before the brakes are caused to set.

The normal control of the two operating motors for each leaf, connected for parallel operation, is by

means of the Bridg-O-Matic control (a-c reactor control system). The speed torque performance of this system provides precision operation under all conditions of leaf load from normal to a 10-lb wind, without the use of any "mechanical" braking, for positive slowdown and reduced speed operation.

Electric power, supplied by two independent networks, is three phase, four wire, 60 cycle at 208/120 volts, stepped up at the bridge through transformers to 480 volts.

An alternate control system may be selected by moving the control selector switch from "Reactor" to "Off." This provides the conventional reversing wound rotor controller with six power points and a drift point. Either motor may be used. (contd.)

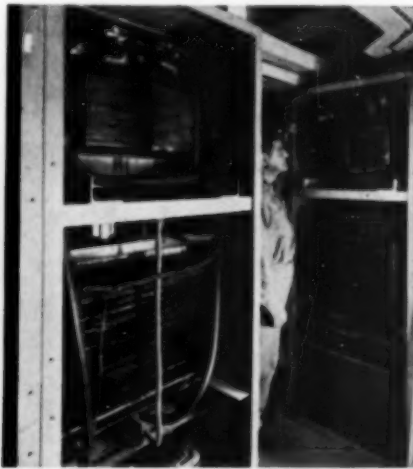
**YOU CAN BE SURE... IF IT'S
Westinghouse**

*Trade-Mark

J-94132-3



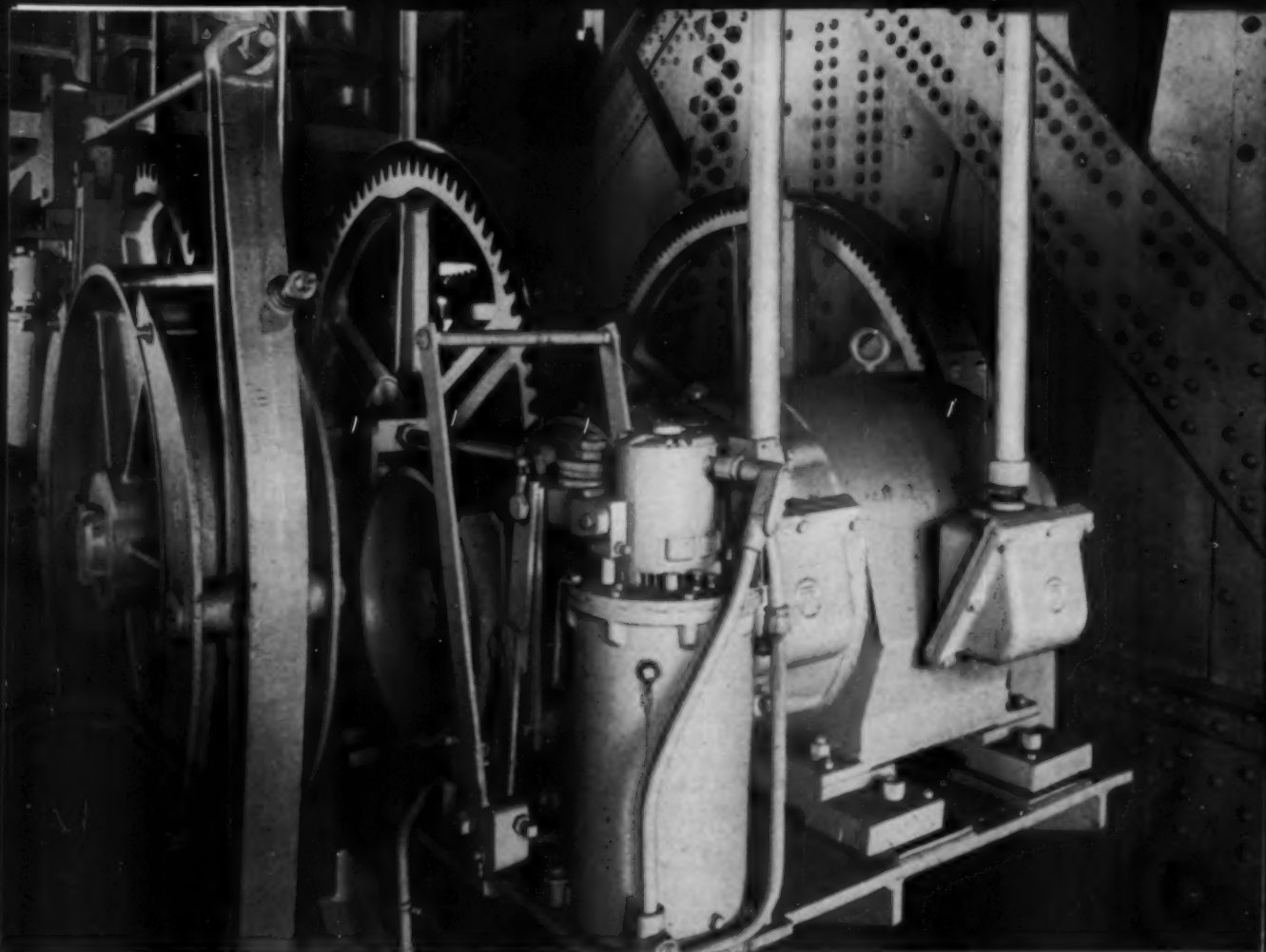
L. A. Johnson, Westinghouse Sales Engineer; E. A. Leske, Electrical Engineer, Divane Brothers Electric Company; and R. H. Keil inspect Westinghouse Magamp control section of bridge switchboard.



Chief Electrician, Robert E. O'Brien, checks cubicles which house Westinghouse primary saturable reactors.



Incoming line cubicle of bridge control (switchboard room, East Pier) is inspected by W. C. Carl; Edward Klausner, Engineer in Charge of Bridge Construction; and R. H. Keil.



Westinghouse Bridg-O-Matic operates Van Buren Street Bridge (contd.)

Interlocks are provided in the control system to prevent operation of leaves until all flashers, traffic lights, gongs and warning horns are operating, traffic gates are down, and bridge centerlocks are withdrawn.

Westinghouse saturable reactor a-c systems offer many possibilities for vertical lift, bascule or swing bridge designs, and other applications such as dam and lock gates, cranes, hoists, etc. For more information call your Westinghouse electrical construction engineer, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. J-94132-4

OWNER & DESIGNER: City of Chicago, Ill.
Department of Public Works, Bureau of Engineering
Division of Bridges and Viaducts

CONSULTING ENGINEER: Hazelet & Erdal, Louisville, Ky., and
Chicago, Ill.

ELECTRICAL CONTRACTOR: Divane Brothers Electric Company,
Chicago, Ill.

SUPERSTRUCTURE-MACHINERY CONTRACTOR:
Overland Construction Company, Chicago, Ill.

STEEL FABRICATOR: American Bridge Division, United States Steel
Corporation, Pittsburgh, Pa.

YOU CAN BE SURE... IF IT'S **Westinghouse**

Tune In Westinghouse-CBS TV-Radio Coverage, Presidential Conventions, July 10-29

View showing one of leaf drives (there are two per leaf), each with Westinghouse 100-hp a-c wound rotor motor and a-c thruster-operated motor and machinery brakes.

John A. Machiels, Bridge Maintenance Machinist, looks at the 225-kva Westinghouse Inerteen[®]-filled step-up transformer which provides 480-volt supply for bridge drive motors and auxiliaries. Type DB-50 wall-mounted circuit breaker provides main feeder protection.





Rust-Oleum is distinctive as your own fingerprint. Accept no substitute.



... goes on faster, stops rust, lasts longer over rust!

ONE MAN often does the work of two!

Easier to use—because Rust-Oleum 769 Damp-Proof Red Primer goes directly over sound rusted metal after scraping and wirebrushing to remove rust scale and loose rust—usually eliminating costly surface preparations. **Stops Rust**—because the specially-processed fish oil vehicle in the 769 Primer penetrates rust to bare metal—helping to drive out air and moisture that cause rust. And it's easily applied by brush, spray, or roller.

Beautifies as it protects—because the Rust-Oleum New Color Horizons System of primers and top coats includes a wide array of smart new colors that resist moisture, fumes, humidity, weathering, etc. Talk to your Chief Engineer—try Rust-Oleum on your tanks, fences, metal sash, roofs, structural steel. See how it lasts and lasts. Consult your Rust-Oleum Industrial Distributor, or write for the New Color Horizons catalog—38 pages, free!

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RUST-OLEUM



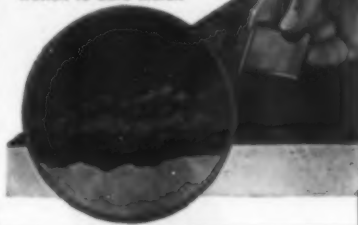
RUST-OLEUM NEW COLOR HORIZONS SYSTEM

Over seventy colors are included in this unique new system that combines four important points: (1) The ability to Stop Rust, (2) smart, modern color harmony, (3) the durability to last and last, (4) ease of application that saves time, money and metal.

STOPS RUST!

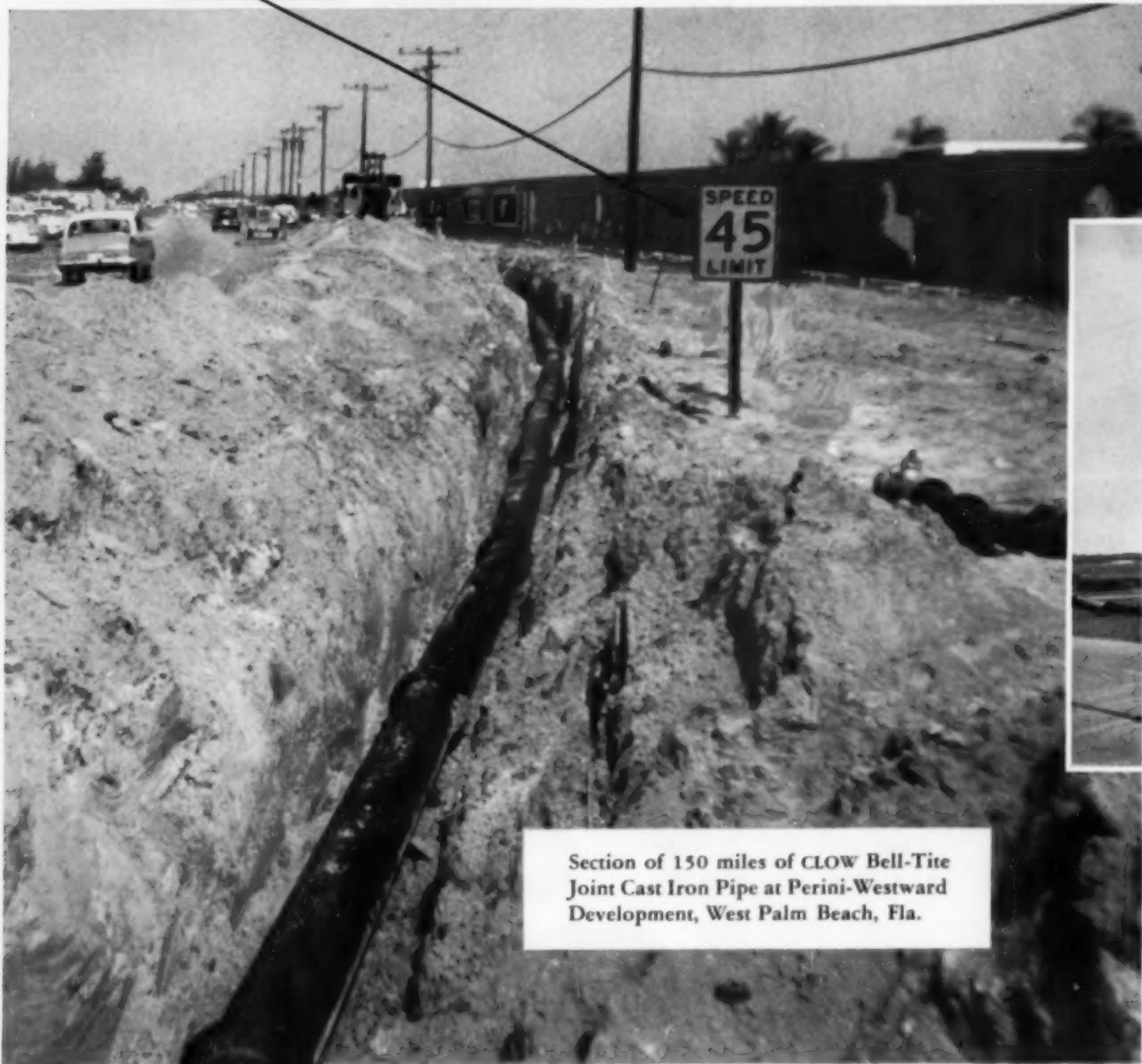
Rust-Oleum and Stops Rust are brand names and registered trademarks of the Rust-Oleum Corporation.

Write for special report showing Rust-Oleum penetration to bare metal.



CLOW

This SIGN applies to the highway



Section of 150 miles of CLOW Bell-Tite Joint Cast Iron Pipe at Perini-Westward Development, West Palm Beach, Fla.

CLOW Cast Iron Pipe Plants are located at
BENSENVILLE, ILLINOIS • BIRMINGHAM, ALABAMA • COSHOCTON, OHIO

**CAST
IRON**



There is no limit to how fast you can lay
CLOW Bell-Tite® JOINT
CAST IRON PIPE



You can install CLOW Bell-Tite Joint Cast Iron Pipe as fast as you can dig a shallow trench. Photo shows the back hoe which clawed open the trench lowering a length of Clow pipe into it.

Over 150 miles of Clow Bell-Tite Joint pipe are the life lines of the water and sewage facilities for this Perini-Westward Development at West Palm Beach, Fla. Time-saving installation plus the economy of material—no accessory but a single molded rubber gasket—are important factors in this \$4,000,000 waterworks project installation. One of the owners of this "City within a City" is Louis R. Perini, chairman of the board of the Milwaukee Braves and president of the Perini corporation.

CLOW Bell-Tite Joint Cast Iron Pipe can speed your installations, too. Let us tell you about its many advantages.

Clow Bell-Tite Joint Pipe saves time and money

Assembly is easy and rapid. Just wipe the joint clean, lubricate and push spigot into the bell. When yellow stripe is no longer visible, joint is bottle tight. A single rubber gasket is the only accessory. There are no bolts, no nuts, no followers, no couplings, no extras.



Patent No. 2898131

CLOW

**CAST
IRON
PIPE**

JAMES B. CLOW & SONS, INC.

201-299 North Talman Avenue, Chicago 80, Illinois

Subsidiaries:

Eddy Valve Company
Waterford, N.Y.

Iowa Valve Company
Oskaloosa, Iowa

New Container System Saves Dothan, Alabama Over \$50,000 Annually

Dothan City Manager R. Powell Black led move to streamline collection system.



By John McCoy
Advertising Manager
Dempster Brothers, Inc.

Dothan, Alabama has accomplished 100% containerization of its commercial refuse, and is enjoying savings of over \$1000 each week.

In addition to the savings, the entire commercial district has a "new look." Scattered piles of refuse, unsightly bins, and knocked-over cans that formerly drew flies and rats constituted a dangerous fire hazard. Today, these trash piles are out of sight, enclosed in big-capacity, all-steel refuse storage containers.

The secret behind the savings lies in mechanized handling of containers in connection with a high-pressure packer body.

Changeover to the new system, one of the largest mass conversions to containerization ever attempted, came

after more than a year's study and an exhaustive cost survey. R. Powell Black, aggressive young city manager, was leader of the movement to streamline the municipal refuse collection system.

Survey Conducted

The refuse survey, conducted under the direction of Mr. Black and Sanitation Superintendent G. J. Parriah, revealed the following facts:

- 1) Direct labor costs (not including equipment operating expenses) ran some sixty-five cents per cubic yard for the 1800 yards of refuse being generated weekly in the commercial district.
- 2) In addition to the fire hazard, scattered trash and double handling of material in bins were consuming a lot of the collection crews' time.
- 3) Fast turnover of collection per-

sonnel was contributing to inefficiency due to the inexperience of replacements.

- 4) Civic leaders and the Houston County Health Department were dissatisfied with sanitation conditions.

From inspection trips to other cities, past experience, and considerable research on the city's specific problems, City Manager Black was convinced that a mechanized container system would be necessary to overcome Dothan's refuse collection ills.

Mechanized System Chosen

In meetings with Sanitation Department and other civic officials, various types of equipment were compared, and the decision was made to recommend the DEMPSTER-DUMPMASER System.

This system consists of a self-loading packer and detachable steel containers. As the containers are filled, the Dump-



Before: Scene at garment factory shows why pick-up crews were delayed.



After: An eight-cubic-yard container encloses unsightly refuse and is emptied in less than 60 seconds.



Dumpmaster approaches eight-cubic-yard container behind store, and engages pick-up arms.



Two CA30-24DB Dumpmasters serve Dothan's commercial district.

master makes its rounds, automatically picking up each container and emptying the contents into its enclosed packer body. Here, the material is compressed to a fraction of its former volume by action of a hydraulically-powered packer plate, enabling the Dumpmaster to haul the equivalent of many truckloads of material on each trip to the disposal area.

Two Dumpmasters and 220 containers were placed in service six months ago with the approval of the City Commission, and preliminary results indicate that savings will surpass the survey's estimate. Labor costs alone, not including truck operational costs, dropped from sixty-five to seven cents per cubic yard, an almost unheard-of figure in municipal commercial collection. With four trucks removed from service, further operational savings are being effected.

Mayor Earle C. Moody and Commissioners Davis and Thrower are pleased

with the attitude of the public and Sanitation Department employees.

Free Survey Offered

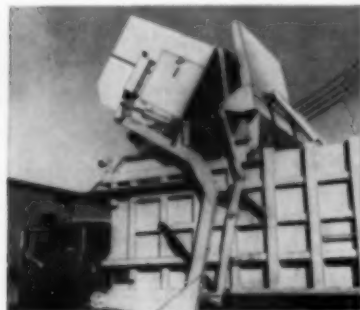
A survey similar to the one made in Dothan can be made by a Dempster engineer in your city without cost or obligation. Write on your letterhead, giving your title. A free 24-page brochure on the Dumpmaster is available on request.

DEMPSTER BROTHERS INC.

Dept. PW-6 Knoxville 17, Tenn.



Huge load of refuse is emptied at disposal area.



Container is lifted and emptied into hopper without driver leaving cab.



A few three-cubic-yard containers strategically placed, serve hundreds of families in this housing area.

DELAWARE COUNTY'S SECOND DISPOSAL PLANT TO BE C-E EQUIPPED

*Like the first plant, now in service, it will
contain 2 C-E Incinerator Stokers*

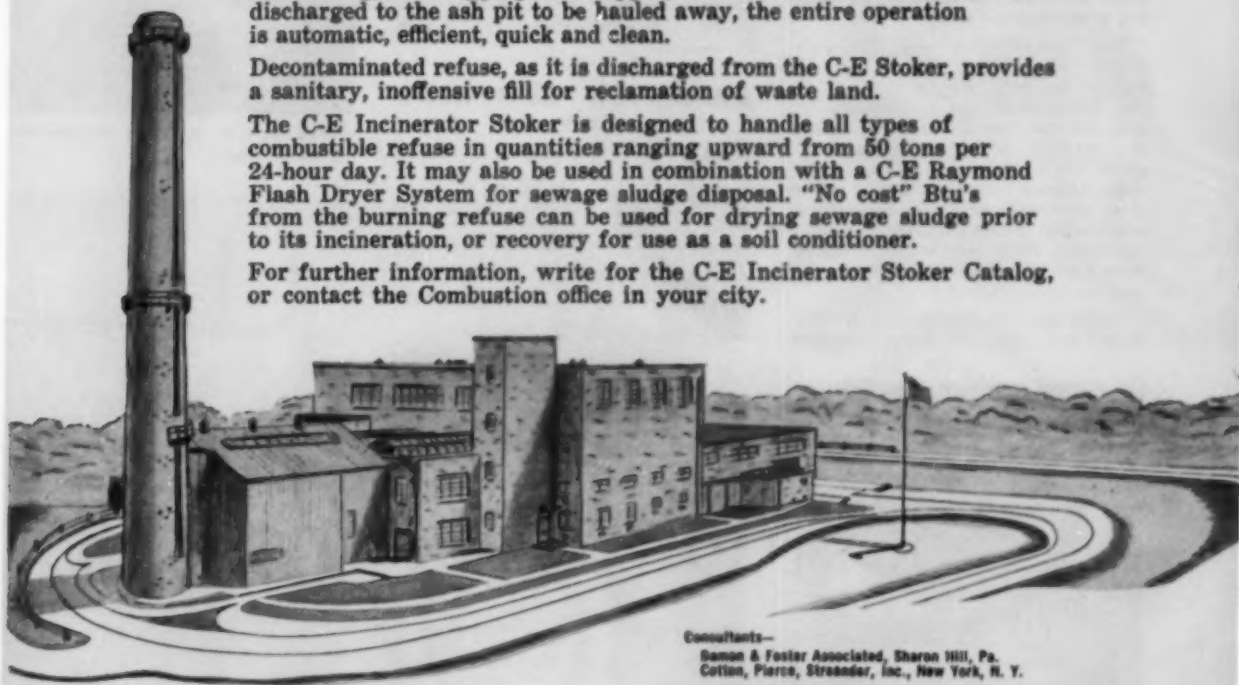
Delaware County, Pa., is effectively solving its refuse disposal problem by developing a highly efficient 3-plant disposal system, each plant capable of incinerating 500 tons of refuse per 24-hour day. The first plant, recently placed in service, contains two C-E Incinerator Stokers, each with a capacity of 250 tons. The second plant, located approximately five miles from the first, is essentially a duplicate installation and will contain two C-E Incinerator Stokers of comparable capacity. All four units are equipped with an inclined "drying" stoker and a horizontal "burning" stoker of the traveling grate type.

Delaware County's choice of "continuous processing" is a matter of sound economics. From the time the refuse is deposited into the self-sealing, non-clogging feed hopper, until the incinerated residue is discharged to the ash pit to be hauled away, the entire operation is automatic, efficient, quick and clean.

Decontaminated refuse, as it is discharged from the C-E Stoker, provides a sanitary, inoffensive fill for reclamation of waste land.

The C-E Incinerator Stoker is designed to handle all types of combustible refuse in quantities ranging upward from 50 tons per 24-hour day. It may also be used in combination with a C-E Raymond Flash Dryer System for sewage sludge disposal. "No cost" Btu's from the burning refuse can be used for drying sewage sludge prior to its incineration, or recovery for use as a soil conditioner.

For further information, write for the C-E Incinerator Stoker Catalog, or contact the Combustion office in your city.



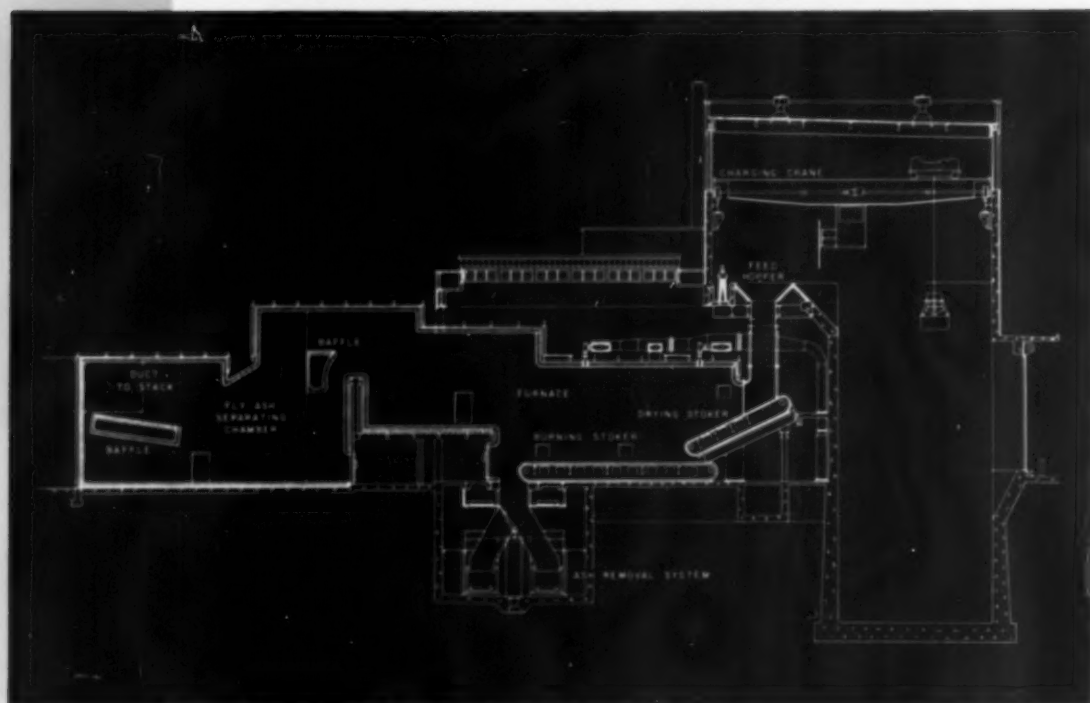
Consultants—

Barton & Foster Associated, Sharon Hill, Pa.
Cotton, Pierce, Strender, Inc., New York, N. Y.

Incinerator Contractor—

Nichols Engineering and Research Corp., New York, N. Y.—Plant #1.
Morse Boulger, Inc., New York, N. Y.—Plant #2.

General arrangements of the first Delaware County Incinerator Plant.
Architect's rendering of this plant appears on opposite page.



HIGHLIGHTS OF C-E DESIGN

- Requires less labor than any other burning method.
- Easy to operate—no heavy stoking or cleaning of fires.
- Assures maximum availability.
- Large hopper and chute provide sealed, continuous supply of refuse.
- Continuous, automatic burning of fuel on grate from front to rear.
- Zone control of air to fuel bed assures maximum combustion efficiency.
- Ratio of overfire and undergrate air easily controlled by use of dampers.
- Continuous discharge of residue from moving grate surface.
- Easily replaceable grate elements.
- Special heat resisting iron—most suitable material—used for grate surface.
- Wide keys over driving chains prevent fouling.
- Steel driving chains, below grate and removed from heat, take all tension.
- Take-up mechanism easily accessible at front.
- Applicable to largest incinerators.
- Provides most economical method of disposal.

COMBUSTION ENGINEERING



C-270

Combustion Engineering Building, 200 Madison Avenue, New York 16, N. Y.
CANADA: Combustion Engineering-Superheater Ltd.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;
PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE



U.S.
cast iron
PIPE

FOR WATER, SEWERAGE AND

saving's in style again!

Today . . . figuring costs . . . you need a sharper-than-ever pencil. And the closer and sharper you figure, the more you need Tyton.[®] The facts: Tyton Joint[®] pipe is easy to assemble . . . can be laid faster even by green crews. Tyton cuts overhead, bookkeeping, storage costs—only one accessory needed. It increases working days . . . can even be laid in rain or wet trench. Simple, speedy, sure, Tyton Joint pipe is tailormade to meet today's rising costs. Judge for yourself. For the full story, write or call.

U.S. PIPE AND FOUNDRY COMPANY
General Office: Birmingham 2, Alabama

A Wholly Integrated Producer from Mines
and Blast Furnaces to Finished Pipe.

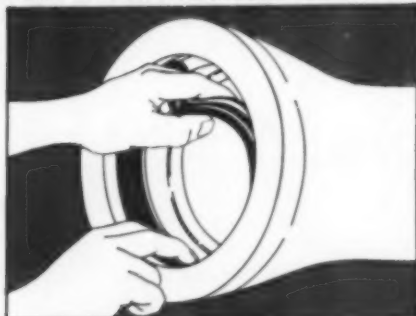


INDUSTRIAL SERVICE

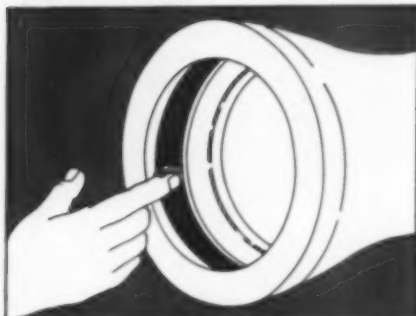


TYTON[®]

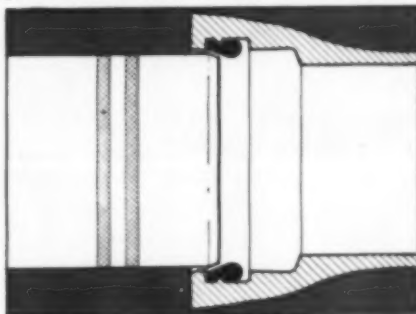
ONLY FOUR SIMPLE ACTIONS



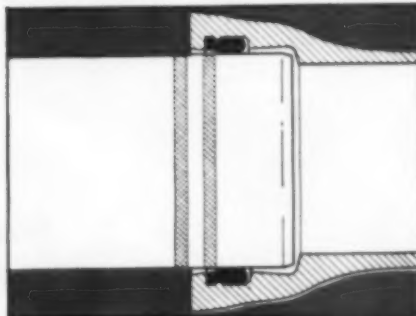
Insert gasket with groove over bead in gasket seat . . . a simple hand operation.



Wipe film of Tyton Joint[®] lubricant over inside of gasket. Your receiving pipe is ready.



Insert plain end of entering pipe until it touches gasket. Note two painted stripes on end.



Push entering pipe until the first painted stripe disappears and the second stripe is approximately flush with bell face. The joint is sealed . . . bottle-tight, permanently! The job's done . . . fast, efficiently, economically. Could anything be simpler?

**CATERPILLAR
ANNOUNCES**

2 NEW



NEW 150 HP 977H WITH 2½ CU. YD. BUCKET

Travel speeds: Forward—Low: 2.0 MPH 1st; 3.6 MPH 2nd. High: 2.5 MPH 1st; 4.7 MPH 2nd. Reverse speeds 25% faster than forward.



NEW 100 HP 955H WITH 1¾ CU. YD. BUCKET

Travel speeds: Forward—Low: 2.1 MPH 1st; 3.9 MPH 2nd. High: 2.7 MPH 1st; 4.9 MPH 2nd. Reverse speeds 25% faster than forward.

TRAXCAVATORS

with Power Shift Transmission and Live Action Hydraulics

977 SERIES H 955 SERIES H

all new for new high production

There is a way to beat higher costs—and that's with increased production. For tractor-loader jobs, here's your answer in the new Series H Cat 977 and 955 Traxcavators. Designed to set a production pace far faster than the models they replace (and other makes of comparable size), they're milestones in tractor-loader progress. With power shift transmission and Live Action Hydraulics, they're the loaders *that never stop*. There may be machines in your line-up that are no longer earning their keep in light of today's more efficient machines. A comparison of your existing tractor-loaders with the new Series H Traxcavators could easily prove these new machines would increase your output at far lower cost than you imagine. Get the facts about them from your Caterpillar Dealer. Ask for a demonstration, too. See how they set a new production pace on the toughest kind of job.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U. S. A.

CATERPILLAR

Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

**TRAXCAVATORS
ARE MAKING OTHER
LOADERS OBSOLETE**

NEW HIGH PRODUCTION FEATURES SPEED LOADING, LIFTING, HAULING, DUMPING...THE FULL CYCLE



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One lever—that's right, one lever gives split-second changes in speed or direction to slash cycle times and increase operator efficiency.



NEW LIVE ACTION HYDRAULICS

Another Caterpillar development! Live Action Hydraulics provide faster lifting speed and greater lifting capacity without robbing power from the tracks.

The 977H Traxcavator packs 41% more hydraulic lifting power—the 955H, 23% more than former models.

MORE HORSEPOWER WITH NEW CAT TURBOCHARGED ENGINES

Up 50% on the 977H—its new Cat D333 Engine develops 150 HP at the flywheel. Up 43% on the 955H with a new Cat D330 Engine that develops 100 flywheel HP.

NEW INCREASED BUCKET CAPACITY

An 11% increase on the new 977H with new 2½ cu. yd. bucket—and a 16.6% increase on the 955H with new 1½ cu. yd. bucket. Complete redesign of engine, power train and chassis provides new machine balance to handle the heavier loads.

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MORE HIGH PRODUCTION FEATURES

A new, two-cylinder gasoline starting engine for positive starts in any weather...and a new dry-type air cleaner that removes at least 99.8% of all dirt from intake air in the worst dust conditions, cuts maintenance time as much as 75%. Retained features include 40° bucket tilt back...automatic bucket positioners and kick out...3-grouser track shoes.

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Bar none, Traxcavators are the most versatile machines you can use. With attachments, you can always keep them working—and working profitably. Attachments available for the new 977 and 955 include the Side Dump Bucket, Rock Bucket, Quarry Bucket, Bulldozer, Ripper and Log and Lumber Forks.

Equipment and Materials for your PUBLIC WORKS PROGRAM

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This Free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

NEW LISTINGS

68-Page Sewer and Culvert Pipe Catalog

310. . . . contains nine sections of the latest engineering information on machine-made roller, suspension, cast, special, reinforced concrete pressure and reinforced concrete subaqueous pipe. Organized for quick reference regarding construction, applications and sizes. A real gold mine of pipe line information. Address Lock Joint Pipe Co., Box 269, East Orange, N. J., or check the number above.

When It Comes to Pumps



circle number on card herewith.

311. You will profit by having this 4-page condensed bulletin which illustrates and describes the Aurora Centrifugal and Apco Turbine Type Pumps with capacity ranges from 1 to 9000 GPM and heads to 600 ft. Just write for your copy to Aurora Pump Div., The New York Air Brake Co., 630 Loucks St., Aurora, Ill., or

Protect Your Trucks and Traffic Signs

312. . . . with high-visibility "Pyralux" fluorescent enamel. Combines safety with decorativeness. Four-page folder, printed in intense fluorescent colors, demonstrates achievement of four times the daylight brightness of conventional hues. For folder just write Du Pont Co., AP-63, Wilmington 98, Del., or circle above card-number.

Sludge Disposal by Incineration

314. . . . is the subject of an informative brochure put out by a leader in the field. Both public works engineers and lay officials will find it lucid in style, enlightening in the presentation, well illustrated. For your copy write Nichols Engineering and Research Corp., 70 Pine St., New York 5, N. Y., or circle our card-number here.

Design of Highway Bridges in Prestressed Concrete

323. Engineers will appreciate this scholarly and clear-cut brochure, replete with formulae and tables covering design procedure. Write for your copy to Portland Cement Association, 33 West Grand Ave., Chicago 10, Ill., or circle our card-number.

Offering a Handbook on Steel Pipe

309. This 40-page "Handbook of Tubular Products" contains dimensions, weights, test pressures, and specifications for Bethlehem continuous butt-weld and electric resistance-weld steel pipe. Standard and tentative specifications for welded and seamless steel pipe are also included. Address Bethlehem Steel Co., Bethlehem, Pa., or let us get it for you by circling card-number above.

Flow Meter Principles and Applications

332. "Bailey Fluid Meters" is the title of a useful reference bulletin that outlines the principles of operation, applications and installation requirements of primary metering elements and recording, indicating and transmitting devices. To get a copy of this well-presented 8-page booklet, Bulletin 20, write to Bailey Meter Co., 1050 Ivanhoe Road, Cleveland 10, Ohio, or check the inquiry card.

Painting Without Drop Cloths

333. . . . is now a possibility with new aluminum-pigment spray paints that dry in minutes. Six colors, low cost application, no mess or splatter. One spray-gun painter can do the work of three with it. Too useful to ignore, and all the details can be had from Tropical Paint Co., 1246 W. 70th St., Cleveland 2, Ohio, or by circling our card-number above.

When You Roll, Roll Right

339. . . . with these Galion Roll-O-Matic tandems. Eight page catalog details advantages and includes complete specifications and compression data. Ask for Catalog 425 direct of The Galion Iron Works & Mfg. Co., Galion, Ohio, or circle above number on reply card.

Gradall Does Too Many Jobs Classify Them

340. The best way to learn how many places and in how many ways the Gradall earth moving and construction machine can speed work and save money for you is by writing for brochure M-2460. You get it from The Warner & Swasey Co., Const. Equipment Div., 5701 Carnegie Ave., Cleveland 3, Ohio, or by circling above card-number.

Making a Clean Sweep

345. . . . on streets, parking lots, airport runways, etc., is the specialty of the Tennant Model 100 Vacuumized Sweeper. Large-capacity machine sweeps a 7'4" path. 6-page illustrated bulletin tells all you want to know of its advantages, operation and efficiencies. For yours write G. H. Tennant Co., 721 N. Lilac Drive, Minneapolis 22, Minn., or circle the reply card.

Parking Meters for Both "On" and "Off Street" Parking

358. An 8-page bulletin (DU-525) covers the subject in text and illustrations. Features described include lower collection-time, easier enforcement, and other advantages and economies. For your copy write Dual Parking Meter Co., (Rockwell Mfg. Co. subsidiary) 400 N. Lexington Ave., Pittsburgh 8, Pa., or circle card-number above.

The Asset of Accuracy in Water Meters

350. . . . is outlined in a folder on conical disc piston meters that provide enhanced sensitivity at low rates of flow with accuracy throughout the full capacity range. For folder on Model HF meters address Hersey-Sparling Meter Co., P. O. Box 31, Dedham, Mass., or check our card-number.

Weeds Getting You Down?

351. Turn the tables on them with selective chemical control. There is a wealth of useful knowledge about this in booklets which await your asking for them from The C. B. Dolge Co., Westport, Conn. Write to them or circle the card-number.

For Tandem Truck Buyers

354. In text and pictures this brochure gives facts that any prospective buyer of tandem trucks can peruse with profit. In it Ford sets forth economies and advantages, and how they will even custom build a tandem to your own exact job specifications. Get your copy by writing Ford Motor Co., Box 2086, Detroit 31, Mich., or circle on reply card.

MORE LISTINGS ON PAGES 36 TO 54

Factory-Built Ejector Stations to Give a Real Lift to Sewage

356. This 14-page catalog is filled with valuable data on latest design pneumatic lift stations. Consulting and City Engineers will find it most useful. Write for Catalog 503 to Schmieg Industries, Inc., Box 4701, Detroit 34, Mich., or circle this number on card.

Button, Button, Who's Got the Button?

373. If it's reflective traffic buttons made from a durable polysulfide base and good for ten years' service that you want, we suggest you write for "Thio-Line" Traffic Button bulletin to Thiokol Chemical Corp., 780 N. Clinton Ave., Trenton 7, N. J., or circle the reply card.

Last Word on Utility Backhoe-Loaders

374. . . . is contained in this bulletin on the Case crawler mounted backhoe loader. Factful specification sheets present eight features of value and interest to equipment users. To get Bulletin CUS-136 address J. I. Case Co., Utility Sales Div., Racine, Wisc., or circle the card.

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June 1960

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Meetings and Conventions

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Pennsylvania Section, Hilton Hotel
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Treas., L. S. Morgan, 413 First Na-
tional Bank Bldg., Greensburg, Pa.

**Virginia Industrial Wastes and
Sewage Works Association**
John Marshall Hotel, Richmond, Va.
June 15-17. Sec.-Treas., Orval J.
Hand, Hercules Powder Co., Hope-
well, Va.

**Central States Sewage and Industrial
Wastes Association**
Lorraine Hotel, Madison, Wis.
June 15-17. Sec.-Treas., Scott E.
Linsley, 2400 Childs Road, St. Paul
6, Minn.

**Ohio Sewage & Industrial Wastes
Treatment Conference**
Neil House, Columbus, Ohio
June 15-17. Sec.-Treas., E. B. Ran-
som, Div. of Sanitary Engineering,
Dept. of Health, 101 N. High St.,
Columbus 15, Ohio.

**Iowa Sewage & Industrial Wastes
Association**
Ottumwa Hotel, Ottumwa, Iowa
June 15-17. Sec., L. F. Skorzeski,
207 S. 15th Ave., Marshalltown,
Iowa.

**New England Water Works
Association Outing**
New Ocean House, Swampscott, Mass.
June 16. Sec., Joseph C. Knox, New
England Interstate Water Pollution
Control Comm., Boston, Mass.

**Pennsylvania Sewage and Industrial
Wastes Association**
Pennsylvania State University, Uni-
versity Park, Pa., August 10-12.
Sec.-Treas., J. R. Harvey, c/o Penna.
Dept. of Health, 993 So. Main St.,
Meadville, Pa.

American Public Works Association
Manhattan Hotel and The Coliseum,
New York, N. Y.
August 14-17. Exec. Dir., Robert D.
Bugar, 1815 E. 60th St., Chicago
87, Ill.

**South Dakota Water & Sewage
Works Conference**
Grand Hotel, Watertown, So. Dak.
Sept. 7-9. Sec., Don C. Kalda, State
Dept. of Health, Pierre, So. Dak.

Institute of Traffic Engineers
Edgewater Beach Hotel, Chicago, Ill.
Sept. 11-15. Exec. Sec., David M.
Baldwin, 2029 K St., N.W., Wash-
ington 6, D. C.

American Water Works Association
Virginia Sec., Cavalier Hotel
Virginia Beach, Va., Sept. 14-16.
Sec., Edward H. Rusch, E. Stuart
Boyer & Assoc., 15 W. Cary St.,
Richmond, Va.

American Water Works Association
New York Sec., Saranac Inn
Saranac Inn, N. Y., Sept. 14-16. Sec.-
Treas., Kimball Blanchard, c/o Nep-
tune Meter Co., 22-22 Jackson Ave.,
Long Island City, N. Y.

**Northern New England Water Works
Association**
Queen Elizabeth Hotel, Montreal, Que-
bec, Sept. 18-22. Sec., Joseph C.
Knox, 73 Tremont St., Boston 6,
Mass.

American Water Works Association
Michigan Sec., Park Place Hotel
Traverse City, Mich., Sept. 21-23.
Exec. Sec., T. L. Vander-Velde, State
Dept. of Health, Lansing, Mich.

**Missouri Sewage & Industrial Wastes
Association**
Hotel Governor, Jefferson City, Mo.
Sept. 25-27. Sec.-Treas., Warren A.
Kramer, Division of Health, State
Office Building, Jefferson City, Mo.

Water Pollution Control Federation
(Formerly the Federation of Sewage
& Industrial Wastes Assoc.) The
Trade & Convention Center, Phila-
delphia, Pa. Oct. 2-6. Exec. Sec.,
Ralph E. Fuhrman, 4435 Wisconsin
Ave., N.W., Washington 16, D.C.

American Public Health Association
Civic Auditorium, San Francisco, Calif.
Oct. 31-Nov. 4. Exec. Dir., Dr. Ber-
wyn F. Mattison, 1790 Broadway,
New York 19, N. Y.

**American Bridge, Tunnel and
Turnpike Association, Inc.**
Sheraton-Atlantic Hotel, New York
City, N. Y., Nov. 14-17. Exec. Sec.,
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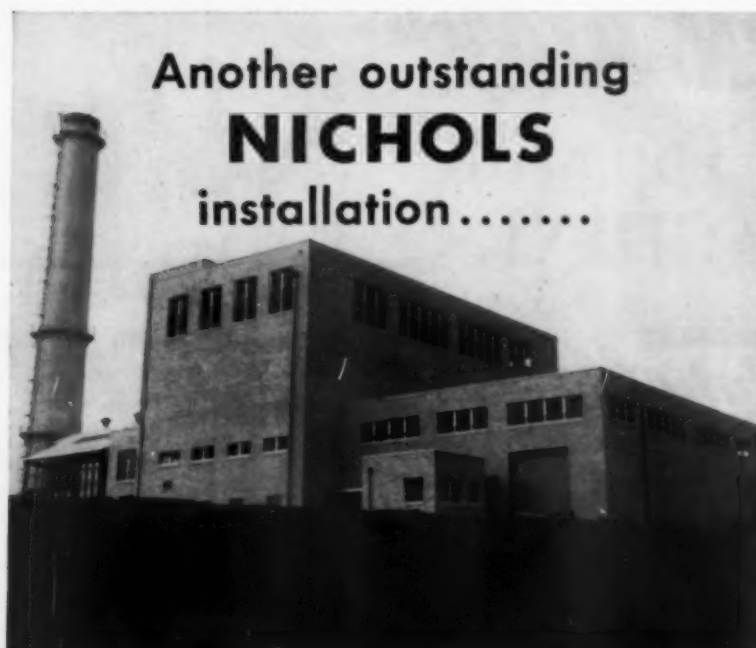
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Vertical Monohearth (For small communities)

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NEW LISTINGS (Cont.)

Handbook of Application Methods For Epoxy Adhesives

369. Details field-tested application methods for bonding concrete. Loaded with pertinent facts and figures for use in your repair and maintenance of highways, buildings, bridges, and other public works applications. Product is E-BOND "Thiokol" LP/Epoxy Adhesive. For 32-page Handbook write International Epoxy Corp., Box A-931, Ft. Lauderdale, Fla., or circle our card-number.

There is Nothing "Eccentric" about these Eccentric Valves

381. They perform unerringly in sewage and water treatment service, giving tight shut-off and easy operation. 8-page Bulletin 110 goes into useful detail on their features, pressure ratings, dimensions and accessories. Write to DeZurik Corp., Sartell, Minn., or circle reply card.

Here's a "Junior" Paint Stripping Machine

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Stand By for the New Word on Standby Power

387. It is in an attractive brochure on the Allis-Chalmers G-138 engine that delivers up to 39 bhp at 1800 rpm. Gasoline or natural gas fuel, suitable for standby power and many other types of portable equipment. For booklet BU-589 address Allis-Chalmers, Tractor Group, Box 512, Milwaukee 1, Wisc., or circle the number on our card.

Use The Reply Card

Get in the Swim

388. . . by getting this comprehensive 16-page catalog on some 400 products for building, improving and maintaining all types of swimming pools. Special section on pool care, water treatment and purification, etc. Address Paragon Swimming Pool Co., Inc., 12 Paulding St., Pleasantville, N. Y., or circle our card-number.

Standardization of a Complete Line of Water Service Equipment

389. Standardization can be a handy thing where the line includes stops, boxes, clamps, strainers, and meter setting equipment. You can find it all at Mueller Co. Address them at Decatur, Ill. for folder W-8880 or just circle the number above on our card.

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There's Plenty of Water—in the Sea

403. If you are near it and water shortages plague you here is a helpful booklet on how to utilize sea water for your supply. Address Richardson Westgarth Inc., 1926 Eye St., N.W., Washington 6, D. C., or circle above card-number.

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To order these helpful booklets check the reply card opposite page 34.

Electrical Equipment for Water Works

408. Whether it is motors, generators, motor-generator sets, switchgear or controls, Ideal offers performance and dependability in these vital parts of water plant operation. For details get Bulletin 305 from Ideal Electric & Manufacturing Co., 370 East First St., Mansfield, Ohio, or use the inquiry card.

Fluorescent Tracers and Detection Equipment

418. It's easier to mass flow and dispersion of liquids and gases with the detection equipment described in this literature on fluorescent dyes and portable fluorometers. For yours, write G. K. Turner Associates, 2425 Fulgas Ave., Palo Alto, Calif., or circle number on inquiry card.

Cutting Costs on Earth Compaction

413. The facts about Duo-Compactors can be your first step to big cost-cutting. Get more compaction with less horsepower. Exclusive principle combines pneumatic tracks with ridge rolling steel, enables you to handle more jobs with better results. Get all data from Seaman-Gunnison Div. of Seaman Corp., Box 3025, Milwaukee 18, Wis., or circle reply card number.

WATER WORKS

Elevated Tanks and Other Storage Facilities

22. Specification sheet covering elevated tank sizes and design and illustrated brochure available from the Darby Corp., Kansas City 15, Kansas.

When You Need Water Stops

129. Have all the facts as contained in free 43-page book MRG 622 of the Gates Rubber Co., 999 So. Broadway, Denver, Colo. Ask them for it, or we will get it for you if you circle their number on card herein.

Equipment For Water, Sewage and Industrial Waste Treatment

34. The complete line of Jeffrey equipment for treatment plants is covered in a 64-page Catalog 952 available from The Jeffrey Mfg. Co., Columbus 16, Ohio. Check the reply card for information on bar and disc type screens, traveling water screens, grinders, grit collectors, garbage grinders, sludge, draw-off valves, chemical feeders, bucket elevators and accumulators to mention some of the equipment.

Propeller Motors For Dependable Water Metering Control

33. The complete line of Measure-Rite propeller meters are described in Bulletin MR-105 available from Measure-Rite, Inc., 4545 W. Brown Deer Rd., Milwaukee 23, Wis. Check the card for details on these accurate meters.

Catalog on Synchronous Motors and Controls

64. A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Information on Service, Valve, Roadway and Meter Boxes

122. Literature on specifications covering "Buffalo" service, valve, roadway and meter boxes, and adjustable valve boxes for water and gas has just been released from Buffalo Pipe & Foundry Corp., Box 55-Station B, Buffalo 7, N. Y. Check the reply card for your information on these valve boxes.

Handbook of Cast Iron Pipes and Fittings

52. Full engineering data on products of the Alabama Pipe Co., including Super De-Lavaud cast iron pressure pipe and pipe fittings, valve boxes and other municipal castings are provided in Pressure Pipe Catalog No. 54, a 196-page publication of Alabama Pipe Co., Anniston, Ala. Weights, dimensions and specifications are clearly indicated in this easy to use in reference.

Brass Goods for the Water Works of America

130. The McDonald line goes all the way from curb stops to goosenecks, corporation stops, couplings—everything pertaining to service connections. Catalog B 100 and PB 60 with much valuable data available from A. Y. McDonald Mfg. Co., 12th & Pine St., Dubuque, Iowa.

Guide Book Information for Emergency Power

153. This book covers what to do when commercial power fails in a fire, flood, hurricane, war and other national disasters. Check the reply card or write Caterpillar Tractor Co., Engine Div., Peoria, Ill., for a copy of "The Four Horsemen of the Space Age."

When Pipe Taps are in Order

157. You will welcome the facts and figures in the new folder on Mueller CL-12 drilling machine. Just ask for Form W-8881 of Mueller Co., 512 W. Cerro Gordo St., Decatur, Ill., or circle above number on the card.

New Light for Meter Readers and Trouble-Shooters

170. Every worker in the dark will welcome the assurance that his flashlight can now be permanently on the job, strong, bright and clear. These rechargeable flashlight battery cartridges outlast thousands of ordinary "one shot" cells. For literature write Battery Div., Sonotone Corp., Elmsford, N. Y., or circle the reply card.

(More listings on page 40)



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Handy little kit weighs only 17½ lbs. and easily saves its cost on your first job. Drills concrete (but not rods), brick, marble, terrazzo, all tiles like crazy; wonderful for anchor holes. Every maintenance crew needs one. Accessories available.

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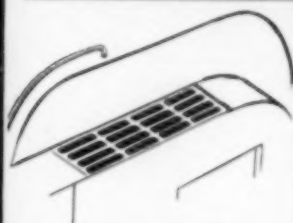
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You asked for these new DELUXE Tandem Rollers that combine the job-tested and proved better QUALITY features of the Heavy-Duty Tandem with the ECONOMY of the Standard-Duty model. Now in one great machine you can be sure you'll get more value for every dollar invested than in any roller equipment ever offered before. The cost is slightly higher than some "make-do" rollers on today's market, but each dollar invested in this outstanding Tandem will pay you dividends in lower maintenance, longer life, better performance and top job speed. Talk first to your Buffalo-Springfield distributor. You'll be money ahead!

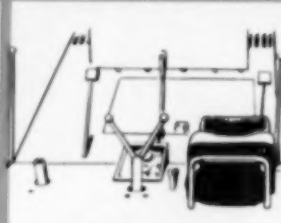
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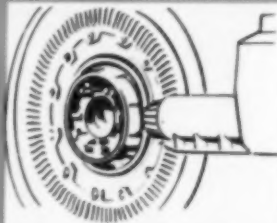
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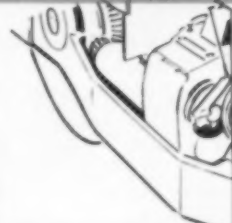
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drive roll enables operator to
see roll edge at all times.



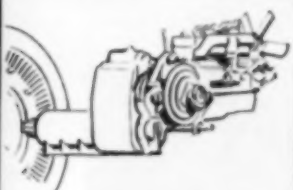
CONVENIENT DUAL CONTROL
Full operation from either
side of machine provides opti-
mum visibility in operation.
Speeds up work.



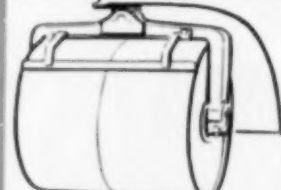
**ADJUSTABLE BEVEL GEAR
FINAL DRIVE** . . Easily adjusted
to maintain positive drive at all
times. Reduces maintenance costs.



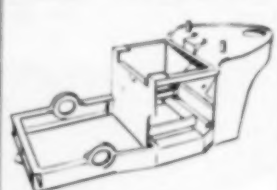
**FULLY-ENCLOSED, ARMORED
FRAME** . . Complete protection
for final drive plus high ground
clearance for closer rolling.



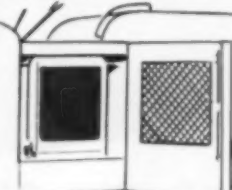
**SINGLE-UNIT POWER TRAIN
ASSEMBLY** . . Your assurance of
precise alignment of all com-
ponents for lasting, trouble-free
performance.



HYDRAULIC POWER STEERING
Low pressure system permits
most accurate control for smooth,
close rolling with minimum op-
erator fatigue.



RIGID CONSTRUCTION . .
Maximum strength, longer op-
erating life and greater rigidity
to keep you fully satisfied with
your new DELUXE.



SIDE AIR INTAKE . . An impor-
tant feature that greatly reduces
danger of clogging and gives
you easier access to radiator.

PLUS . . LONG-LIFE TAPERED ROLLER BEAR-
INGS so each roller moves smoothly, freely for longer
wear, easier action . . SPECIAL MANGANESE ALLOY
MACHINED ROLLS for maximum toughness, longest
wear . . HIGH-SPEED, LOW-TORQUE REVERS-

ING CLUTCHES for smoothest reversing without
grabbing, longest clutch life . . TROUBLE-FREE, RUST-
PROOF SPRINKLER SYSTEM uses brass pipes, copper
tubing and large capacity tank with filter. SEND FOR
FULL INFORMATION.



BUFFALO-SPRINGFIELD COMPANY

SPRINGFIELD, OHIO

Please send me your complete data on
Models KT24E and KT25E Tandem Rollers

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COMPANY

STREET

CITY STATE

K A Division of
KOEHRING
Company

To order these helpful booklets check the reply card opposite page 34.

Heavy Duty Swimming Pool Equipment for Municipal Pools

193. Illustrated bulletin showing heavy built diving and deck equipment is available from American Playground Device Co., Anderson, Ind. Check the reply card for specifications on diving boards, data on diving stands, towers, slides, pool ladders and pool cleaning

Data Book For Engineers

199. New Link-Belt Catalog (No. 2617) includes all recent additions to their Water, Sewage and Industrial Waste treatment equipment. All designing engineers will want this one. Write Link-Belt Co., Colmar, Pa., or use the card.

Why Hunt All Over the Place?

201. Instead, use this 32 page cross-indexed catalog for quick easy reference equipment, trade names and applications. Covers all major equipment in the complete Infileo line. Write for Bulletin 80 to Infileo Inc., P.O. Box 5033, Tucson, Arizona.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 33 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Manual on

Coatings to Stop Rust

225. Primer type, short oil type, heat resistant, chemical resistant and floor coatings are a few of the items covered. Also complete data on Rust-Oleum products are included. Check the reply card or write Rust-Oleum Corp., Evanston, Ill., for this valuable manual

Manual on Filter Bed Agitators

206. General information—specifications and installation data regarding the application of Palmer agitators, or rotary surface wash in vertical and horizontal pressure filters—round, square and rectangular open gravity type filters are covered in Manual from Palmer Filter Equipment Co., 822 East 8th St., P. O. Box 1696, Erie, Penna. Check the reply card.

U. S. Tyton Joint Pipe

210. An eight page booklet on centrifugally cast, Tyton Joint® pipe for water or other liquids is available. Tyton Joint cast iron pipe is provided with a simple, sturdy and tight slip-on type of joint. Illustrations show details of joint and method of assembly. Write U. S. Pipe & Foundry Co., Birmingham 2, Ala., or check the reply card.

Here Are The Facts On Plastic Pipe

243. This 36-page handbook gives complete design data on Kraloy PVC plastic pipe and fittings, including dimensional information, pressure and temperature ranges and a nomograph for calculation of friction loss. For your copy address Kraloy Plastic Pipe Co., Inc., Box 22048, Los Angeles 22, Calif.

Paints For Bridges, Water

Tanks & Other Metal Structures

258. Flake silica graphite paints for outdoor metals are described fully in literature from Paint Sales Div., Joseph Dixon Crucible Co., Jersey City 3, N. J. Check the reply card for details on these primer and protective paints.

Do You Know the Value of the V-Notch?

293. A new booklet tells what you want to know about how chlorine feeding can be made as regular and precise as the sunrise. Ask for "The V-Notch Story" direct of Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J., or check the card-number.

Outline of Modern Water Treatment Equipment

248. Bulletin 4437 is recommended for engineers who need a basic refresher course on treatment of municipal and industrial water. It lists water impurities and methods of treatment and illustrates treatment systems and equipment. Check the reply card or write The Permutit Co., a Division of Pfaunder-Permutit Inc., 30 West 44th St., New York 36, N. Y., for your copy.

Helpful Data on

Swing Check Valves

253. . . . Horizontal swing check valves in sizes 4 through 12 inches; hub, mechanical and flanged joints; all working parts interchangeable. Fully described in Form N-7 of James B. Claw & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill. Circle our card-number.

Compact, One-Man

Trencher Has 5 Digging Widths

256. Municipalities, contractors, utilities and others will like the low-cost, heavy duty Arpa Model MA-2 Trench Devil. Digs up to 54" deep, 8" wide. Get new 6-page bulletin from Arpa Corporation, New Holstein, Wisc.

Water, People and Hydrodynamics

302. . . . is the title of an illuminating booklet dealing with the world-wide problem of how to get water in adequate supply, when and where needed. Your copy can be had for the asking of Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Ill., or use the reply card.

Helpful Data on

Water Meters

336. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 23, Wisconsin.

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SERVE MODERN INDUSTRY...

SANTA FE WOOD TANKS & PIPE are found as standard equipment in many modern industrial installations. Over 50 years of experience in developing and manufacturing precision wood products enables Santa Fe to supply the correct type of equipment for your needs. Wood Tanks & Pipe are an economical and efficient answer to many liquid storing, handling and processing problems.

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One man, in one day, makes 540 collections!



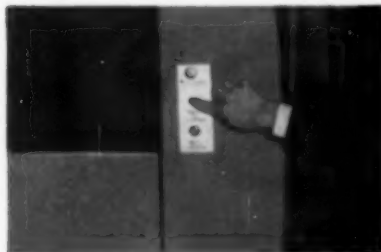
**"Our Hydro E-Z Packs fit perfectly
into our profit operation."**—



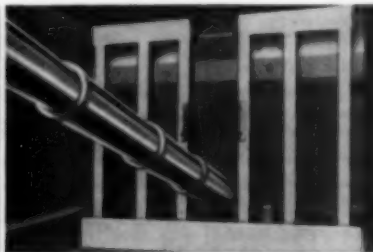
RUSSELL SNOW,
Manager,
Refuse Service, Inc.

In Battle Creek, Mich., one man with a Hydro E-Z Pack makes 540 residential collections a day for Refuse Service, Inc., with only one trip to the landfill. This most powerful of all refuse compactors applies a 76,600 lb. squeeze to reduce garbage and all refuse to a compact bale. At the landfill the compactor blade

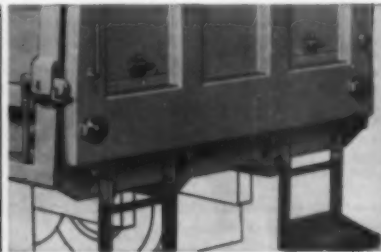
pushes the load out through the endgate in less than 90 seconds. No hoisting or weighting needed! You can see why Russell Snow, Manager, says, "Our E-Z Packs fit perfectly into our profit operation." Now write us. We'll help arrange a demonstration and send you a free copy of an informative book, "The Big Squeeze."



Automatic cycling—simple push button control of packer blade makes one-man operation easier, faster than ever.



Reinforced blade moves on two enclosed tracks on sides. 84" bearing area prevents twisting, eliminates drag.



Watertight and sanitary! Six strong latches (with level release) hold one-piece door in contact with seal.



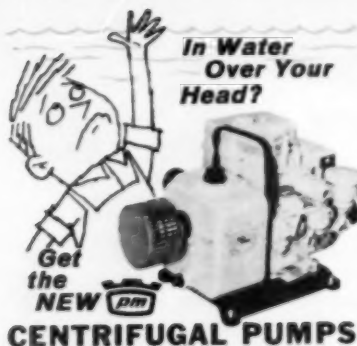
HYDRO E-Z PACK®

HYDRO E-Z PACK DIVISION OF HERCULES GALION PRODUCTS, INC., GALION, OHIO, U.S.A.

For Better Patches Heat and Remix Stockpiled Asphalt

HEAT-A-MIX TAILGATE ASPHALT MIXER

For heating and remixing stockpiled asphalt. Can be operated in forward and reverse for better blending of material. No fire in pugmill—asphalt made hot and workable by indirect heat. Has its own gasoline engine and propane or kerosene heating system. Mounts quickly and easily on truck tailgate. Removable and adjustable legs make it easy to transfer unit from one truck to another without use of crane or hoist.



Carriable • Self-Priming • Lightweight

Exclusive PM engineering combines the advantages of replaceable iron volute with an aluminum body. 2" model weighs just 45 pounds! LOOK at these features:

- NO CHECK VALVE OR PEELER to clog or wear out!—Saves you \$15 every 6 months!
- 4-CYCLE ENGINE with automatic recoil starter and oil bath cleaner—Saves you \$20 labor per month!
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- PATENTED IMPELLER DESIGN keeps seal free of debris and dirt—Saves \$10 maintenance each month!
- SPECIAL LOW COST, LONG LIFE SEAL saves \$12 replacement cost!

Ask your PM field representative for a demonstration today!

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8345 Hayvenhurst, Sepulveda 9, Calif.
Manufacturers of the Thomas Electric Organ



Technical Bulletin on Swimming Pool Filtration Equipment

328. A 24-page technical Bulletin 626, designed to help persons planning pools which must comply with local and state health regulations, is now available from the R. P. Adams Co., Inc., 328 East Park Drive, Buffalo 17, N. Y. Check the reply card for data on size selection charts, typical installations and drawings.

Testing

Water Meters

353. This 40-page catalog is a discussion of fundamentals and a guide to sound practice in meter maintenance. It covers standard specifications of meter accuracy, descriptions of the latest developments in meter testing equipment and many drawings and diagrams. For your copy write The Ford Meter Box Co., Inc., Wauhash, Indiana, or check the reply card.

Helpful Data on Swimming Pools

364. Data on injector nozzles for complete recirculation, fittings for correct drainage and other useful information for pool design are covered in Manual SP issued by Josam Mfg. Co., Michigan City, Ind.

Book Tells

How to Control Algae

371. Details on the control of various microscopic organisms frequently found in water supplies are furnished in a 44-page booklet offered by Phelps Dodge Refining Co., 300 Park Ave., New York 22, N. Y. Check the reply card.

385-HP Engine For Standby Pumps and Generator Sets

373. International 385-hp compact heavy-duty 4-cycle, 6-cylinder engine is well illustrated in literature from International Construction Equipment, International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill. Check the reply card for full specifications.

Modern, Welded Constructed Elevated Steel Tanks

382. Revised edition of Horton ellipsoidal elevated steel tanks of welded construction is available from Chicago Bridge & Iron Co., Advertising Dept., 332 South Michigan Ave., Chicago 4, Ill. The catalog is well illustrated and contains a table of standard tank dimensions for capacities ranging from 40,000 to 500,000 gals.

A Flat Statement

About Round Tanks

434. The title of a new finely illustrated booklet is "Steel Tanks Store Water Best." It gives pictures, essential data, and a fine impression of strength, water-tightness and beauty combined in sturdy structures. For your copy write Steel Plate Fabricators Association, 105 W. Madison St., Chicago 2, Ill., or check our card.

Gas and Gasoline

Engines Described in Literature

335. Rollie engines (formerly LeRoll), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

Manual on Valves,

Fire Hydrants and Accessories

359. A 244-page manual covering Darling valves and fire hydrants in a broad range of types, sizes and constructions is available from Darling Valve & Mfg. Co., Williamsport, Pa. Engineering data, application tips, valve accessories information, reference data on materials, specifications and standards are covered.

Need a Flow Meter?

Here's a New One . . .

642. . . to meet need for a low-cost yet accurate and dependable instrument for measuring open-channel sewage flows. Compact, portable, mechanically operated, needs no external power. Interchangeable cams and scales for various flumes and weirs. Many other features. Get Bulletins 24 and 28 from Leopold & Stevens Instruments, Inc., 4445 N. E. Glisan St., Portland 13, Oregon, or check reply card.

Handbook on How to

Lay Concrete Pressure Pipe

324. Manual on concrete pipe laying instructions is available from Price Brothers Co., Dayton, Ohio. Check the reply card for information on how to dig the trench and handle the pipe, make the joint and the pipe bedding procedure.

Pipe that Baffles the

Most Determined Roots

356. Orangeburg root-proof pipe and fittings for house sewer lines and other outdoor underground non-pressure applications. Also Orangeburg Perforated Pipe for subsurface drainage, septic tank fields, etc. Catalog 307 is yours for the asking and tells all about them. Address Orangeburg Mfg. Co., Div. The Flintkote Co., 375 Park Ave., New York 22, N. Y., or circle the card-number.

Electronic Locators for Water

Mains, Services, Valves and Boxes

477. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours and weighs only four lbs. when completely assembled is described in literature from Wilkinson Products Co., 3067 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

Bulletin Covers Step-by-Step

Action on the Water Problem

409. A step-by-step outline of action telling how the responsible citizens can help their officials extend and improve the local water system through more adequate rate structures on financing is covered in this bulletin available from Thos. F. Wolfe, Managing Director, East from Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Illinois.

Use The Reply Card

Water Filtration

Costs Can Be Reduced

492. The "Celite" system of diatomite filtration makes possible reduced installation cost, with space requirements a fraction of those for equivalent sand filtration. For informative literature write Johns-Manville, Box 14, New York 16, N. Y.

Measure Water Accurately

In Open Ditches and Channels

494. Farshall Measuring Flumes are widely used by Irrigation Companies, Farmers, Cities and Industries. All steel construction assures accuracy within 2%. Available in sizes for 0.1 to 1340.0 cubic feet per second. Catalog B-31-C contains free-flow discharge tables, sizes, capacities and weights. Thompson Pipe & Steel Co., 3025 Larimer Street, Denver 1, Colorado will send you a free copy for the asking.

WEED & DUST CONTROL

Chemical for

Roadside Weed Maintenance

234. Garlon is an easy to prepare and to use chemical in the control of roadside weeds and growth. For complete data write The Dow Chemical Co., Agricultural Chemicals Sales, Midland, Mich., or check the reply card.

How to Stop

Bothersome Dust

433. A bulletin that covers the use of calcium chloride in the control of dust is available from Wyandotte Chemicals Corp., Michigan Alkali Div., Wyandotte, Mich. Tables on the use of calcium chloride pay are included. Check the reply card.

Control Weeds and

Brush Along Highways

640. Literature from Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio, describes how use of weed and brush killers help reduce accidents and also included is a handy, ready-reference control chart that covers weed control problems, quantity of solution to use and economical application. Check the reply card.



TYLOX Rubber PIPE GASKETS

It takes only a few seconds to couple Tylox-Gasketed sewer pipe, but even more important than that, finished joints *stay* tight, preventing leakage in or out, and making future maintenance unnecessary by eliminating root and sediment problems. The installation above was a joint project of the Virginia Polytechnic Institute and the Town of Blacksburg, Virginia, R. Stuart Royer & Associates, Consultants, Richmond, Va. Pipe work was by Gimbert and Gimbert Construction Co., Roanoke, Va., and 15" Tylox-Gasketed Pipe was furnished by Roanoke Concrete Products Co., Inc., also of Roanoke.

Pipe joints formed with Tylox rubber Gaskets stay tight because they keep their original elasticity. Under ground and under compression, sewerage and industrial waste acids won't deteriorate the specially compounded Tylox rubber, and pipe angularities from shifting soils or overburdens can't break their seal. Leakage, with resultant evils of root and sediment penetration is whipped because it *can't start!* Waste disposal designers and builders know this... and it is why there are more TYLOX Gaskets in low head service than all other types of gaskets combined. As for speed of assembly, there's no joint that can be coupled any faster than TYLOX.

WRITE FOR MORE TYLOX INFORMATION



If you are not thoroughly familiar with its time-saving, cost-saving engineering advantages, Tylox Joints are the one sure way to get water-tight pipe lines at less pipe-laying cost.

HAMILTON KENT MANUFACTURING COMPANY

KENT, OHIO

427 West Grant St.

ORchard 3-9555

CANADIAN PLANT: 10 Brussels St., New Toronto, Ont., Clifford 1-2494

5134

To order these helpful booklets check the reply card opposite page 34.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Tricking Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Tricking Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

You Don't Need a Big Plant to Get Big Savings

21. . . . in mechanical sludge dewatering. Now the smaller plant can cut power costs, eliminate use of chemicals and reduce labor. 4-page bulletin on the "Roto-Plus" sewage sludge concentrator shows how this is accomplished. Write for Bulletin 100 to Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y., or check the card-number.

Entirely New Small Sewage Treatment Plant

40. The Sparjair units are package type plants that range in size from a 50 population equivalent to 5000 and utilize the contact stabilization process to produce a clear, nuisance free effluent. Copies of Bulletin 19-S-54 are available from Walker Process, P. O. Box 266, Aurora, Ill., or check the reply card.

Automatic Engine Control Equipment Manual

83. This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recommendations, control selection chart, accessory selection chart, safety stop controls and alarm sets are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, Ill.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Packaged Underground Lift Station

124. Selection tables and detailed drawings of packaged underground lift stations with "Flush Kleen" sewage pumps are available in literature from Chicago Pump Co., 622 Diversey Parkway, Chicago 4, Ill. Check the reply card today.

For Prompt Service Use The Reply Card

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif., or check the reply card for illustrated folder.

Stationary Diesels For Water and Sewage Plants

167. Engines are four-cycle, 6 or 8 cylinder, in-line models, ranging from 190 to 2150 bhp and from 135 to 1500 KW, are available either naturally aspirated or supercharged, and can be furnished to run as diesel, dual-fuel or gas engines. For Bulletin #115A check the reply card or write White Diesel Engine Div., The White Motor Co., Springfield, Ohio.

Incinerators for the Disposal of Combustible Wastes

217. Bulletin 179 from the Morse Boulder Inc., New York 17, N. Y., describes fully the basic principles of incineration as to combustion, auxiliary burners, draft and control and elimination of fly ash. Specifications and design of incinerators and hopper doors are included.

Gravity Sewer Pipe Engineering Classifications

305. A quick method for choosing the most economical class of asbestos-cement sewer pipe to suit each laying condition with handy crushing table based on the Marston formula is available from Keasbey & Mattison Co., Ambler, Penna. Check the reply card.

Diesel Engines For Municipal Power Needs

359. Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., 18th & Florida Sts., San Francisco 10, Calif.

Trenchers for Water and Sewer Line Construction

384. Three Cleveland J trenchers incorporating major advances in trencher design and operating advantages are described in Bulletin L-104 available from The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio. Check the reply card for digging capacities, specifications and dimensions.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Colifilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 106 by the Komline-Sanderson Engineering Corp., Peasack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.



THE NAME ORANGEBURG AND THE SILVER BAND ARE REGISTERED TRADE-MARKS OF THE ORANGEBURG MANUFACTURING CO.

Over 300 million feet in use coast to coast!

The test of time has proved the high quality of Orangeburg Root-Proof Pipe and Fittings for house sewer lines, downspout run-offs and other underground, non-pressure uses.

Orangeburg's Taperweld Joints seal root-proof and watertight. No leakage, no infiltration. And because it's made of a strong, tough non-metallic material, Orangeburg does not rust. Alternate freezing and thawing... acids and alkalis found in ground water and sewage do not affect it.

All these qualities plus speed, ease and economy of installation have

gained for Orangeburg a growing acceptance among leading approving authorities, architects, engineers, builders and plumbers. Today, over 300 million feet of Orangeburg are in service from Maine to California.

The Silver Band* identifies genuine Orangeburg: Root-Proof Pipe for sewer lines; Perforated Pipe for foundation drains, septic tank disposal fields. Orangeburg exceeds requirements Federal Spec. SS-P-356 and Commercial Standard CS 116-54. Write Dept. PW-60 for Engineer's independent report.



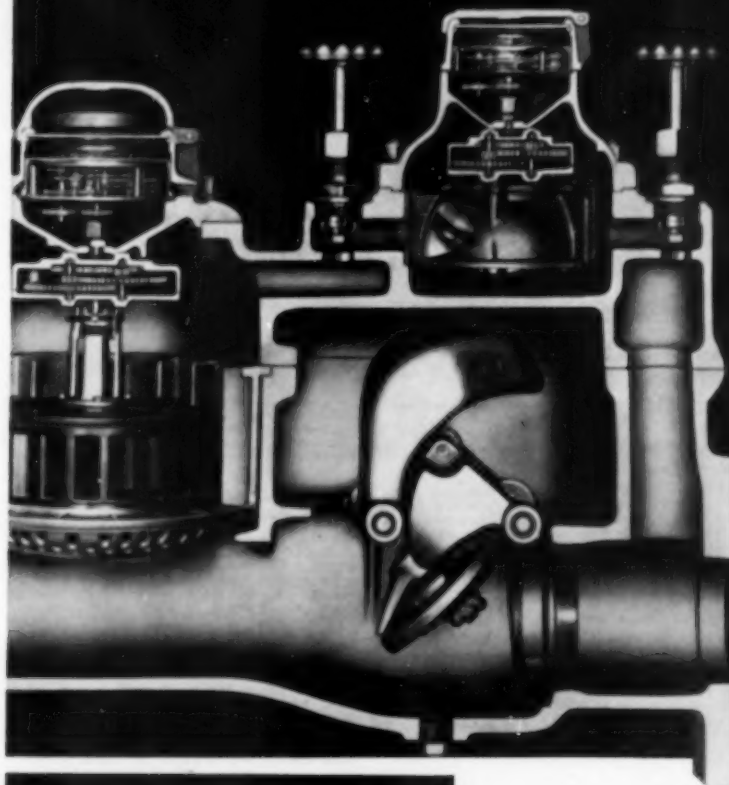
ORANGEBURG MANUFACTURING CO.
Division of The Flinckote Company, Manufacturer
of America's Broadest Line of Building Products

genuine ORANGEBURG®
Root-Proof Pipe and Fittings

PUBLIC WORKS for June, 1960

HERSEY

Two Reasons Why Hersey Compound Meters (CT) are No.1 Choice



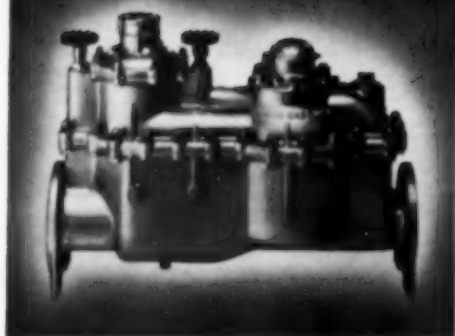
1.

Valves make it possible to shut off the by pass meter without closing the main line meter — an exclusive feature.

2.

The counter-balanced lever valve causes a decrease in pressure loss at rates of flow above 10% of maximum — an exclusive feature.

HERSEY COMPOUND METER
(MODEL CT)
the Leader in its Field



In addition to the features shown above, the Hersey Compound Meter (Model CT) uses the Hersey Disc Meter (Model HD) on its bypass. Model HD has a conical disc piston which provides extra sensitivity due to this exclusive design feature. It also has a three part chamber in which the chamber ring seldom requires repairs.

Easier maintenance, less maintenance, low loss of head, more accurate measurements at all rates of flow are features that make the Hersey Compound Water Meter (Model CT) the leader.

Hersey-Sparling
Meter Company

HERSEY PRODUCTS
DEDHAM, MASSACHUSETTS



One should keep
to old roads and
old friends.

—German proverb

OLD FRIENDS, yes. Old roads, maybe. They're a lot like farm-fresh eggs. Variable. How good the egg is depends on the farm it comes from . . . and how good the road is depends on the district you're in.

I've crossed a good many county lines in my day . . . sometimes for better, sometimes for worse. And when I see a smooth, clean, solid unpaved road turn into a rough-riding dust trap at the line . . . it brings out the missionary in me.

Unpaved roads need calcium chloride. It keeps them compact and dust-free. And the annual outlay is unbelievably low . . . about a nickel a square yard. Compare that with resurfacing costs. Often, you can avoid costly resurfacing jobs by keeping unpaved roads in shape to serve heavier traffic with chloride . . . so it can free funds for better maintenance of paved roads. Which means that you can save money, or stretch it . . . or both . . . by giving chloride its rightful place in your maintenance program. Our folder, "Wyandotte Calcium Chloride for Dustproofing", gives a number of hints on how. Write for it. **Wyandotte Chemicals Corporation**, Wyandotte, Michigan. Offices in principal cities.

Wyandotte
CHEMICALS



MICHIGAN ALKALI DIVISION
HEADQUARTERS FOR CALCIUM CHLORIDE

Sludge Pumps That Can Take It

436. Built by specialists in sewage treatment equipment, these new Dual Valve sludge pumps are described in fact-filled folder written to fit designing engineers' needs. For your copy address: **Komline-Sanderson Engineering Corp.**, Peapack, N. J., or circle our card.

Data on Adjustable-Speed Magnetic Drives for Low-Lift Pumps

468. A catalog is available from **Electric Machinery Mfg. Co.**, Minneapolis 13, Minn., that tells all about E-M Vertical Synchronous Motors and Magnetic Drive Units. Engineers check the reply card for information on this equipment for sewage pumps.

Valuable Information on Incinerator Stokers

505. The Combustion Engineering stoker is described fully in Catalog No. IS-1 which is available from **Combustion Engineering, Inc.**, Combustion Engineering Bldg., 1132 W. Blackhawk St., Chicago 22, Ill. Schematic drawings of the units, advantages of incineration, firing methods, design and performance are sections covered. Check the reply card today.

Separation of Suspended Solids in Water and Sewage Treatment

512. A 24-page bulletin covering the complete line of clarifier and oxidator mechanisms is available from **Process Engineers, Div. of The Emco Corp.**, 634 South Fourth West St., Salt Lake City, Utah. Check the reply card for the basic types that cover a full range of tank sizes and load requirements, and special units for unusual conditions.

Design Manual on Sectional Plate Pipes, Arches and Pipe-Arches

550. Size and strength tables, minimum gages for live load strutt and unstrutt, layout details and plan developments are some of the material covered in this manual. Write **American Bridge Div., United States Steel Corp.**, 525 William Penn Place, Pittsburgh, Pa., or check the reply card today.

Putting Small Sewage Treatment Plants in the "Big Time"

557. Four equipment units that get big plant results in small plant operation are featured in an 8-page booklet "Small Plant Sewage Treatment." Drawings and flow sheets give the details. Write **Dorr-Oliver Inc.**, Stamford, Conn. for Bulletin 6692 or use the reply card.

Technical Bulletins to Design or Check by . . .

600. for water and sewage plants. They are now available as No. 100 on Venturi tubes; No. 720 on supervisory control; No. 1003 on mechanically operated rate-of-flow and level-of-head gauges; No. 1004 on pneumatic single and double indicating receivers; and No. 1225 on controlled closing air valves. For the set, write **Simplex Valve and Meter Co.**, Lancaster, Pa., or circle our card number.

Save Money While Pumping Sewage or Storm Water

616. New line of prefabricated pumping stations hold down on-the-job costs and give new economies. Ideal for municipalities, housing projects, sanitary districts, resorts, shopping centers, etc. Address **Zimmer & Franconson**, 1715 15th Street Place, Moline, Ill., or circle card-number.

Give a Lift to Your Sewage

638. With the new advanced-design **TEX-VIT** packaged pump station. Full of new features that make for efficiency in pressure controls, improved air circulation based on superior components. For names of municipal users, and Bulletin PS-60 just address **TEX-VIT Supply Co.**, Manufacturing Division, Mineral Wells, Texas, or circle the number on our card.

Make Your Concrete Sewers Still Better . . .

653. . . by using **TYLOX** gaskets in the joints. Rubber and neoprene, available for all pipe sizes, afford quickly-made, watertight, flexible, durable and chemically-resistant joints. New 20-page brochure "Tylox Rubber Gaskets" covers all these advantages in detail. Address **Hamilton Kent Mfg. Co.**, Kent, Ohio, or circle the card-number above.

Controls For Use in Pumping Stations and Sewage Plants

662. Single and multi-pump sump controls, pressure operated for use in pumping stations and sewage disposal plants are described in literature available from **Healy-Kuff Co.**, Water Level Controls Div., 2255 University Ave., St. Paul 14, Minn. The two principal types of pressure operated sump controls are covered along with general descriptions and features.

Catalog on Steel Grating

665. New ideas in flooring, walkways, stair treads, platforms and shelving are covered in Catalog 2527R available from **Blaw-Knox Co.**, Dept. W., Pittsburgh 38, Pa. Check the reply card for information on choice of cross bar and bearing bar designs and spacings.

Full Line of Sewer Cleaning Equipment

681. Everything for rodding sewers from hand operated equipment to the fully mechanized **SewerRoder**. Tools for all types of stoppages are operated by **Flexicrome Steel Sewer Rods**. Featuring the **Truck-Loader** which dumps sewer deposits directly into truck, a complete range of **Bucket Machines** is offered. All equipment is described in 48-page Catalog 59-A, **Flexible, Inc.**, 3786 Durango Ave., Los Angeles 34, Calif.

STREET LIGHTING AND TRAFFIC CONTROL

Much Cheaper than Cops . . .

31. Is good street lighting in preventing crime. To guide you to better lighting there is a new Kerrigan booklet. "A Bright City is a Safe City." Describes full line of lighting standards, also how to promote better lighting in your city and county. Address, **Lighting Standard Div., Kerrigan Iron Works Co.**, 1033 Herman St., Nashville, Tenn. or use our card.

Complete Catalog on Traffic Control Equipment

340. All types of controllers, PR system of coordinated traffic control, vehicle detectors, timers, vehicle counters and radar speed meters are covered in catalog available from **Automatic Signal Div., Eastern Industries Inc.**, Norwalk, Conn. Check the reply card.

Manual on All Types of Traffic Signs

379. This 26-page manual covers regulatory, warning, school, railroad, street name, road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write **The Micro-Flex Co., Inc.**, 1824 East Second St., Wichita 14, Kans.

Sign Catalog Has Latest Specifications

417. Detailed information on all classifications of standard signs for traffic control, street identification and other purposes together with a complete line of accessories is presented in a convenient Sign Manual by **Lyle Signs, Inc.**, 2731 University Ave., S. E., Minneapolis 14, Minn. Get Catalog B-55 for most recent data and specifications on U. S. Standard signs.

Highway Hazard Warnings

545. Gathered in one booklet is practically the whole story on warning devices and how to use them. Catalog 55 is veritable gold mine of such information. Covers lanterns, flashers, torches, safety suggestions. For your copy write **R. E. Dietz Co.**, 225 Wilkinson St., Syracuse, N. Y., or circle card-number.

Where to Get Those Indispensable Traffic Cones

663. Why you need them, where they are most useful, with full descriptions and dimensions. Rubber or plastic, with or without adapters, flasher lights and flags. Just write for attractive four-color bulletin to **Radiator Specialty Co.**, 1400 W. Independence Blvd., Charlotte 8, N. C., or circle above number on card.

SERIES

22

SERVICE AND MAINTENANCE BODIES



Four Models... Four Sizes

**COMPARTMENTIZED TO
FIT SPECIFIC JOB NEEDS**

Which Series 22 Body do you need? Take a look... there's a model especially designed for your particular type of service work. The durable, all-steel unit shown above, equipped with an optional overhead rack, is widely used for general service work in all operations. Other models for electric, telephone and gas service have similar compartments fitted with various shelves and bins to meet specific work needs. Result: You get a custom-made body at a mass-produced price... plus increased crew efficiency on every job.

Series 22 Body features include flat, 16-gauge compartment tops... rust-proof, cadmium-plated door latches... nylon bushings in all door hinges... key-locking, weathertight doors... recessed, slam-action door catches... corrugated steel floor.

Available in 75", 90" and 104" lengths, equipped with accessories to fit your particular need.



Need more storage space? Any of the four Series 22 models can be furnished with an all-steel superstructure. In addition to any optional items desired, the superstructure is fitted with two full-length shelves and three swivel hooks on each side, a window in the head panel and grab handles at the rear.



Self-Elevating Ladder Assembly

This time-saving assembly with six rubber-covered rollers and four powerful coil springs enables one man to quickly and effortlessly erect a ladder up to 36' in length. The operator lightly pushes the end of the ladder down, and the springs do the lifting. Stowing is equally fast and easy. Ideal for use on 75", 90" and 104" bodies. Includes 28', 30', 32', 34' or 36' two-section extension ladder.



FOR ELECTRIC WORK



Series 22-E. Designed for service work in any phase of the electric utility industry. Special shelves and bins carry all the equipment and materials needed in the field.

FOR TELEPHONE WORK



Series 22-T. Compartmentized to carry a variety of telephone service tools, parts and materials. Standard arrangement of shelves and bins enables crewmen to quickly find items needed on the job.

FOR GAS WORK



Series 22-G. Two variations of this model are available for carrying either gas or linemen. Rubber-padded compartments insure the safe storage of fragile parts and instruments.

Plenty of additional bins, shelves and racks carry tools, pipe, fittings, parts and all other equipment needed on routine or emergency service and maintenance calls.

Another reason why
UTILITIES EXPECT MORE FROM

POWERS *American*

UTILITY BODIES AND EQUIPMENT

McCABE-POWERS BODY COMPANY

2000 No. Broadway
ST. LOUIS 15, MO.

825 Cedar Street
BERKELEY 10, CALIF.

1461 E. Washington Blvd.
LOS ANGELES 21, CALIF.

5525 S.E. 28th Ave.
PORTLAND 3, ORE.

To order these helpful booklets check the reply card opposite page 34.

STREETS AND HIGHWAYS

How to Prepare and Maintain Roadways With Calcium Chloride

45. "The Calcium Chloride Road" is the name of a new 24-page two-color catalog issued by the Columbia-Southern Chemical Corp., 632 Fort Duquesne Blvd., Pittsburgh 22, Pa. Included are sections on dust control, gradation, placing and mixing materials and shaping. General information on spring, summer and fall maintenance is also provided.

Useful Attachments for "Payload" Tractor Shovels

95. Increased versatility for Hough "Payload" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc.

Use The Reply Card

Two New Tractor Shovels

117. To deliver maximum production combined with fast, economical operation two new models have been announced. Each has three interchangeable buckets and the famous Trojan Safety Curve Lift Arms. Ask for specification bulletins from The Yale & Towne Mfg. Co., Trojan Div., Batavia, N. Y., or circle their number on the card.

"Quick-Way" has News for You

125. Get the story on their new truck cranes and shovels, 8½ ton and up, that offer a rating to fit your job at a cost to fit your budget. For the full details, write "Quick-Way" Truck Shovel Co., P.O. Box 1800, Denver 5, Colo., or circle number on our card.

Eats 'Em Alive

136. Whether your materials reduction problem is concerned with refuse, garbage, tree branches, old tires, or what not, there's an M & M Hog that can chew it up into easily handleable shape. Catalog H 854 tells all about it. For yours write Mitts & Merrill Co., 1009 So. Water St., Saginaw, Mich., or just circle the number on card.

Chip Dollars from Your Overhead With Fitchburg Chippers

166. Detailed cutaway drawings, specifications, diagrams, charts and money-saving reports and experiences are covered in catalog available from Fitchburg Engineering Corp., Dept. PW, Fitchburg, Mass.

Damaged Barricades Can Be Repaired With PM Barricade Kits

163. PM barricade kits provide a flexible replacement system for damaged barricades. Check the reply card or write Pacific Mercury, 8345 Hayvenhurst Ave., Sepulveda, Calif., for details on PM transistor neon or incandescent flasher warning lights.

Sand and Cinder Spreaders For Streets and Highways

175. PTO with mechanical or hydraulic operation and auxiliary engine with mechanical or hydraulic operation are the choice of drives on these sand and cinder spreaders. Check the reply card or write Baughman Mfg. Co., 152 Shipman Road, Jerseyville, Ill., for complete catalog.

Why and How To Use Pneumatic Tired Rollers

290. The why and how of pneumatic tired rollers on base and surface courses, sealing completed fills, surface treatments, floated surfaces, hot and cold asphalt and stabilized soils are covered in Bulletin 10 from Tampo Mfg. Co., San Antonio, Tex. For information on operating conditions and compaction charts check the reply card.

New Methods and Materials For Mounting Sweeper Brooms

393. Simplified core filling with long lasting plastic filaments is described in fact sheet. Write Rynal Corporation, 114 St. Joseph St., Arcadia, Calif., or check the reply card.

No Idle Trucks with these Spreaders

397. New 8-page catalog gives features, specifications, users' statements on the Fox Mountable spreaders, equally good for sand, cinders, chips, salt, calcium chloride. Designed for one-man operation and year-round use. Wide widths and high speeds. Mounts or demounts in 15 minutes. Write Fox River Tractor Co., Box 469, Appleton, Wisc., or check our card number.

3 and 4-cu. yd. Tractor Shovels With Torque Converter Drives

415. Operating, performance and maintenance advantages offered by the Allis-Chalmers HD-16G and HD-21G torque converter drive tractor shovels are described in 8-page catalog MS-1274, available from Allis-Chalmers Mfg. Co., Construction Machinery Div., Milwaukee, Wisc. Check the reply card for specifications.

1960 Truck Line Story From Chevrolet

446. The 1960 Chevrolet truck line is described fully in literature from Chevrolet Motor Division, General Motors Corp., General Motors Building, Detroit 2, Michigan. Check the reply card for data on this line of 163 models.

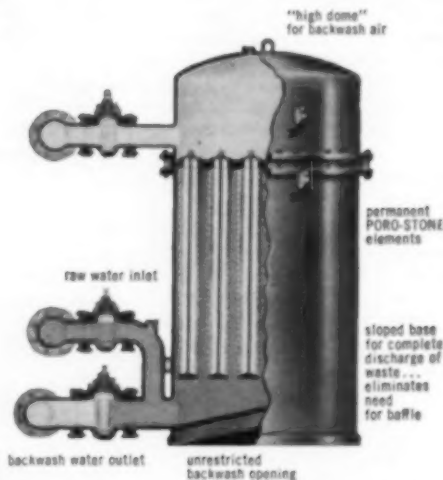
Levels Sidewalks and Curbs Quickly and Easily

510. How the Mud-Jack Method for raising concrete curb, gutters, walks and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the reply card.

ADAMS SWIMMING POOL FILTERS

- PERMANENTLY TROUBLE-FREE OPERATION
- CRYSTAL-CLEAR WATER AT LOWEST COST
- SAVINGS IN FIRST COSTS, LABOR, CHEMICALS

Adams SPF Diatomite Filters require only a fraction of the installed space of sand filters of equivalent filter capacity. Operation is very simple—nothing to disassemble or replace. Adams "pressure dome" backwashing is easy, rapid and extremely thorough yet requires a minimum amount of wash water—"...the only diatomite filter with backwashing that works", as one pool operator puts it. Adams Poro-Stone filter tubes are rugged and inert to corrosion—none has ever needed replacing. And Adams diatomite filtration removes microscopic particles including many bacteria, greatly reducing your requirements for chlorination, precipitants and Ph control. Write for Bulletin 626 for details on better filtration... by the country's largest manufacturer of filters for public and commercial swimming pools.



MUNICIPAL POOL

...at Winnsboro, S.C. One Adams SPF-238 Filter keeps its 300,000 gallons crystal-clear. Pool designed by Hugh N. Thompson, City Manager, Winnsboro, S.C. General Contractor: John C. Stewart Co., Winnsboro, S.C.

R. P. ADAMS CO., INC.
228 EAST PARK DRIVE
BUFFALO 17, N. Y.



Long lengths and light weights cut installation time

...when you specify Beth-Cu-Loy for drainage structures

One of the chief advantages of using drainage pipe made of Beth-Cu-Loy galvanized steel sheets is the long lengths—and the light weights—that are feasible. Here's an example: a 20-ft length of 18-in. diameter pipe made of 16-ga Beth-Cu-Loy weighs but a trifle over 300 lb.

Easy to Lift... Easy to Make Joints

Only the simplest of lifting machinery is needed to unload and place the Beth-Cu-Loy pipe in the trench. And, of course, the long lengths reduce the number of field joints, enabling the laying crews to keep right up with the trench diggers. The joints themselves are simple and time-saving.

Steel for Strength, Durability... Flexibility, too

Light though it is, pipe made of Beth-Cu-Loy has the great strength of steel, and the corrosion-resistance of zinc. It is flexible enough to "give" with the fill and help distribute the load around its own periphery. It conforms well to grade and alignment, and absorbs impact, vibration, and the shifting effect of weather changes.

Beth-Cu-Loy sheets meet the rigid specs of the American Association of State Highway Officials. If you would like further details about Beth-Cu-Loy sheets for durable drainage pipe, just get in touch with any Bethlehem sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor, Bethlehem Steel Export Corporation

BETHLEHEM STEEL



For Strength
... Economy
... Versatility

To order these helpful booklets check the reply card opposite page 34.

Self-Propelled

Ditching Machines

438. Information on a self-propelled one man operated ditching machine, model 524 T, model W-2 and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4 1/4 feet deep. Model W-2 Ditcher digs from 2" wide up to 4" down to a depth of 30". Full data on these ditchers available by checking the reply card.

Helpful Data on Distributors

for Bituminous Materials

611. Pressure distributors featuring uniform pressure and temperature, accurate displacement pumping, convenient operation are described in literature of Standard Steel Works, North Kansas City, Mo.

Literature on Reflective Glass Beads

571. Glass beads for traffic signs and street name signs are described in literature available from FLEX-O-LITE MFG. CORP., 8301 FLEX-O-LITE DRIVE, P. O. Box 3066 (Arlton Br.) St. Louis 23, Mo. No. 831 high index of refraction glass beads for white and yellow backgrounds and UB 68 medium index of refraction glass beads for reflectorizing dark colors such as red, green, blue, etc.

For Soil Sampling and Pavement Coring

576. There's an easier way to do both with Acker equipment. Bulletin 26-R describes a kit containing 12 different soil sampling tools. Bulletin 40-R tells about the All-Purpose auger for all types of sub-surface exploration. Bulletin 700-R illustrates the Acker Shear Test Kit for in-place shear tests in soft areas. Name the ones you want. Acker Drill Company, Inc. Box 830, Scranton, Pa., or check our card.

Pre-Assembled Dowel Units For Highway and Airport Construction

537. Laclede dowel assemblies for expansion, contraction and construction joints are precision welded into one unit and are maintained in rigid alignment. For full details write Laclede Steel Co., St. Louis, Mo., or check the reply card today.

The Tractors that Put the Utility into Utility Tractors

618. Low profile, high clearance, and a new Shuttle clutch, power steering are a few features. For the full story write Allis-Chalmers Mfg. Co., Milwaukee 1, Wis., for Utility Tractors literature, or circle our card-number.

"Rip the Daylights out of Masonry Sawings Costs"

635. What to do it with is fully described in new literature "New from Truco" on drilling machines, bits and accessories; also concrete, masonry and stone saws and diamond blades. Address Truco Masonry Drilling Division, Wheel Tracing Co., 3200 West Davison, Detroit 38, Mich., or circle number on our card.

Get "Down to Earth" Quickly With Mobile Drill's "Explorer"

646. Multi-purpose drill augers to 75 ft.; core drills to 500 ft.; borer holes up to 24-in. diameter. Full details on this powerful yet lightweight unit from Mobile Drilling, Inc., 960 No. Pennsylvania St., Indianapolis 4, Indiana. Check the reply card.

Prestressed Concrete in Your Construction Needs

647. Prestressed beams, slabs and girders for bridges are covered in information available from American Steel & Wire, Rockefeller Bldg., Cleveland 13, Ohio. Check the reply card for complete details.

To Heat and Re-Mix Stockpiled Asphalt

654. . . . the Wylie HEAT-A-MIX Tailgate Asphalt Mixer can ease your labors. New 4-page fully illustrated brochure describes how it works and why you need it. Address Wylie Mfg. Co., Box 7086, Oklahoma City 12, Okla., or circle above number on card.

Here's a King-Sized Sucker-Upper . . .

656. . . . that will rid your streets and gutters of leaves, litter and other bulky materials in record time. Cleans catch basins to 8-ft. depth in minutes. Bulletin PL 758 S describes and illustrates this motorized Sucker-Upper. Address Good Roads Machinery Corp., Minerva, Ohio, or circle number on card.

Transit Cranes for Bridge and Highway Building

691. Transit cranes that can lift 33,000 lbs. at 20-ft. radius, and 13,000 lbs. at 40-ft. radius with 60-ft. boom and outriggers are described in literature from Bucyrus-Erie Co., South Milwaukee, Wisconsin. Also featured are load control, folding boom and boom lengths.

CONSTRUCTION EQUIPMENT AND MATERIALS

Don't Stand There Figuring!

51. Use the new Forney PSI Calculator "slide rule" for concrete products that includes instant conversion data from total load to psi on 17 standard test specimens and masonry units. Pocket size. Free. Address Forney's Inc., Tester Div., Box 310, New Castle, Pa.

Black Top Maintenance and Construction Equipment Catalog

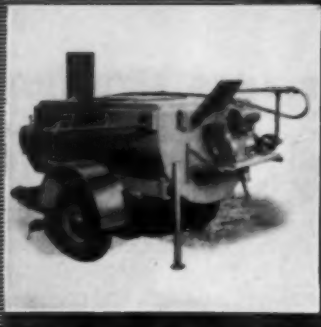
114. A highly informative catalog covering the field of road maintenance and construction equipment is available from Littleford Bros., Inc., 457 E. Pearl St., Cincinnati 2, Ohio. Check the reply card.

Patch ROADS THE LOW COST WAY

Temperature Easily Controlled

Easy to Transport

Saves Money on Patchwork



STANDARD STEEL TAR-KETTLES

PATCH AND MOVE ON IN MINUTES AND SECONDS

With this Standard Steel Model "S" Kettle, "cold spots" or "burnt materials" are eliminated. You get uniformity of heat throughout the entire mass of material. Steady temperature at the correct level is maintained all day long. Easily transported—equipped with special safety features—it's a fast worker. With a motor spray attachment, it is even more efficient for road maintenance. Standard Steel also offers a complete line of crack filling pots, shoulder rollers and other road maintenance equipment.

WRITE FOR CATALOG AND PRICES

OTHER PRODUCTS OF STANDARD STEEL

Asphalt Pressure Distributors, Maintenance Distributors, Patch Rollers, Supply Tanks, Tool Heaters, Asphalt Tools, Steel Flushers, Construction Brooms.



Standard Steel Works, Inc. NORTH KANSAS CITY, MO.

JOB RECORDS PROVE ...

EIMCOBELT
Continuous Belt
DRUM FILTERS

Increase Rates, Cut Costs, Handling Any Sewage Sludge!

OGDEN, UTAH

RAW SLUDGE — Rates of 10 and 11 Lb. Per Hour, Chemical Costs About \$9 a Dry Ton

The new \$4,800,000 Central Weber Sewer Improvement District plant at Ogden, Utah, employs two EimcoBelt filters for dewatering raw primary and trickling filter sludge.

The sludge at Ogden is probably one of the most difficult to filter in the United States. Influent sewage contains packing house, plating mill and cannery wastes, has often carried unusual amounts of grease, fats, feathers.

Results, with EimcoBelt filters equipped with synthetic fabric media, have been spectacular. After operating techniques were established, cake production has been 10 and 11 lb. dry weight solids per hour. Chemical costs have been \$9.11 per ton of dry cake, moisture content about 70%. Maintenance has become a negligible factor.

EimcoBelt is the only continuous vacuum filter that successfully removes a fabric type medium from the drum for cake discharge and cloth washing. Blinding is eliminated. Filtrate blow-back is not possible. The EimcoBelt returns a thoroughly cleaned medium to the drum every filter cycle.

ACTUAL 5-MONTH OPERATING RECORD AT OGDEN, WITH EIMCOBELT FILTERS

	Raw Sewage (M.G.)	Cake Moisture Per Cent	Dry FeCl ₃ Addition Per Cent	Dry CaO Addition Per Cent	Dry Solids Per Sq Ft Per Hr Lb
OCT. 1959	444.01	69.0	1.8	10.1	9.7
NOV. 1959	479.86	70.4	2.3	8.9	10.8
DEC. 1959	376.9	71.2	1.8	8.8	11.6
JAN. 1960	414.54	70.9	1.4	6.6	11.6
FEB. 1960	520.0	69.6	1.6	8.9	10.3

Sludge is dewatered on two 11½-ft. diameter by 12-ft. EimcoBelt filters. Ogden plant was designed by Henningson, Durham and Richardson, Inc., Omaha, Neb., and Grix, Mueller and Plowman, Ogden, Utah.

SCHENECTADY, N. Y.
DIGESTED
PRIMARY SLUDGE
EIMCOBELT FILTER

SPOKANE, WASH.
DIGESTED PRIMARY
ELutriATED SLUDGE
EIMCOBELT FILTERS

GRAND RAPIDS, MICH.
DIGESTED PRIMARY AND
WASTE ACTIVATED SLUDGE
EIMCOBELT FILTERS

For more facts, call the Eimco representative in your area, or write Eimco Filter Division for EimcoBelt Bulletin F-2053.

THE EIMCO CORPORATION



FILTER DIVISION

634 SOUTH 4TH WEST
SALT LAKE CITY, UTAH — U.S.A.

RESEARCH AND DEVELOPMENT CENTER
301 SO. RICKS ROAD, PALATINE, ILLINOIS

8-587

To order these helpful booklets check the reply card opposite page 34.

International Wagner Heavy-Duty Loaders and Backhoes

195. International Wagner loaders and backhoes are matched with International utility tractors and are described in Catalog CR-1076-I available from International Harvester Co., Consumer Relations Dept., 180 N. Michigan Ave., Chicago 1, Ill. Check the reply card.

The Name is Clark

229. . . . The product is a line of Tractor Scrapers, Dozers and Shovels that make your operators happy with powerful heavy-duty equipment, engineered for fast performance on tough jobs. For full details address Clark Equipment Co., Construction Machinery Div., Benton Harbor, Mich., or check our card.

This Expansion Bolt Will Let You Sleep Nights

279. When you anchor the smallest fixture or the heaviest machinery in concrete, masonry or any non-frangible material with Wej-it bolts they stay anchored. Catalog with details and specifications, free from Kirel Inc., Kingston, N. Y., or circle our card number.

The Principles of Compaction by Vibration

388. Compaction specifications that can't be met with ordinary compactors are no problem to the new Essick vibrating rollers. Complete descriptive literature explaining the principles of compaction by vibration and the Essick vibrating roller is available from Essick Mfg. Co., 1950 Santa Fe Ave., Los Angeles, Calif.

Hopto Hydraulic Excavators in 1/8 to 1/2 Yard Size

299. Five models of Hopto backhoes, all featuring heavy-duty boom, positive uninterrupted swing, 180° wrist action, dual purpose stabilizers and easy-to-use controls are described and specified in an informative 12-page booklet. Get your copy of Form H-5719 from Badger Div., Warner & Swasey Co., Winona, Minn. Check the inquiry card.

Information on Boring Machines

345. General operating instructions for the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Earthworm Boring Machine, Inc., P. O. Box 1108, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included.

Complete Line of Road Rollers and Compaction Equipment

320. Buffalo-Springfield's complete line of road rollers and compaction equipment is described in a 12-page illustrated Bulletin No. S-73-137 just released by Buffalo-Springfield Co., Division of Koehring Co., Springfield, Ohio. Check the reply card for on-the-job pictures, as well as construction details of the 2-axle tandem, 3-axle tandem, 3-wheel rollers and the K-45 Kompactor.

New Grader Bulletin Available . . .

347. . . . describes the construction of graders and their features, including the new constant mesh transmission. In addition there is a new 4-page two-color Specification Sheet, which also features the optional equipment available on Huber-Warco motor graders. Get yours by writing Huber-Warco Co., North Greenwood St., Marion, Ohio, or circle the number on card.

A Completely Hydraulic Ladder

610. This completely hydraulic ladder is described in a new catalog published by J. H. Helan Corp., 4100 West 150th St., Cleveland 11, Ohio. Detailed drawing of the pedestal, throttle control and ladder construction are included.

Portable Water Coolers Used on Maintenance and Construction Work

651. Igloo cans and coolers are perma-lined and range in capacity from 2 to 15 gals. Models and sizes are covered in bulletin available from Igloo Corp., P. O. Box 8227, Memphis 4, Tenn., or by checking the reply card.

Literature on Concrete Gunning Equipment

695. The application of gunned concrete and allied equipment used for mixing the dry blend mix for this operation is described in Form No. C7-59, furnished by the Air Placement Equipment Company, 1000 West 25th Street, Kansas City 8, Missouri.

Catalog on Utility Bodies and Equipment

698. General Service Bodies; Maintenance Bodies; Line Construction Bodies; Mechanical and Hydraulic Aerial Ladders; SKY-MASTERS (Aerial Devices); Winches; Hydraulic Derrieks; Pole Trailers; Hydraulic Cable Reel Trailers; and Related Accessory Items of Equipment. Write McCabe-Powers Body Co., 5900 N. Broadway, St. Louis 15, Mo.

REFUSE COLLECTION AND DISPOSAL

What You Should Know About Refuse Incineration

30. Two helpful bulletins tell what you should know about low cost refuse incineration for the small community and for larger cities. Your questions on mechanical stoking, burning rates and operating problems are discussed. Get Bulletins 217A and 223A from Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y. Just check the reply card.

Reduce Your Refuse Disposal Costs

180. A complete line of refuse disposal systems that include containers, giant containers, compaction bodies and compaction trailers are described in literature from Dempster Brothers, Dept. PW, Knoxville 17, Tenn. Check the reply card for data on these efficient systems.



MCDONALD'S
104 YEARS



OF EXPERIENCE
STAND BEHIND
THIS PRODUCT

McDonald 4717 Curb Stop — Minneapolis pattern. Combined cap and tee handle inverted key curb stop. Both ends copper pipe couplings. Round way. Also available in stop and drain patterns. Sizes — $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$ and 2 inches. A catalog of McDonald's complete line of water works brass goods is available on request. Write to:

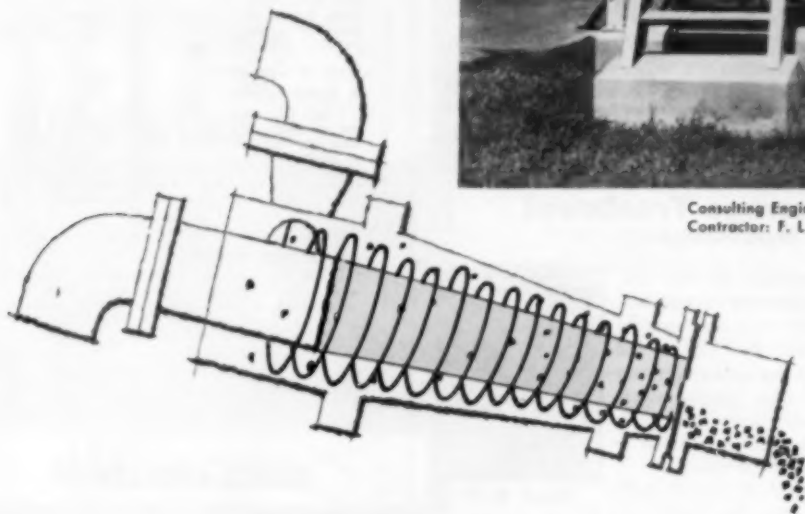
A. Y. McDONALD MFG. CO. Dept. PWM-660, 12th & Pine, Dubuque, Iowa. • Brass Goods • Pumps • Oil Equipment • Drainage Products

DorrClone[®] Degritting

*pays off at
High Point, N.C.
Treatment Plant*



Consulting Engineer: Wm. F. Freeman Inc., High Point, N. C.
Contractor: F. L. Showalter, Inc., Lynchburg, Va.



Operating in combination with a 16' dia. Dorr Detritor[®], a 12" dia. DorrClone washes 190 gpm of grit from the collecting tank underflow at North Carolina's High Point Sewage Treatment Plant. DorrClone degritting reduces subsequent treatment loads, improves overall efficiency.

The DorrClone is a simple, highly efficient device that operates without moving parts. Centrifugal force separates the grit as the feed swirls round a conical chamber. The grit is

thrown against the walls and discharged at the apex valve at the lower end of the cone. The lighter sewage and sludge, together with most of the liquid, flows out the overflow pipe.

Applications include degritting of raw sewage prior to primary sedimentation, washing of Detritor Collecting Tank underflow and degritting of primary clarifier underflow prior to Den-sludge Thickening. For more information, write to Dorr-Oliver Incorporated, Stamford, Conn.



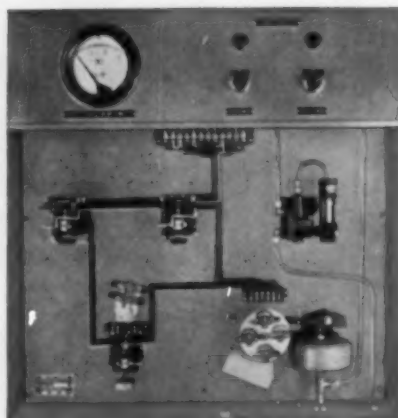
To order these helpful booklets check the reply card opposite page 34.

PRESSURE-OPERATED SUMP CONTROL

The RPS Rototrol is a pressure-operated sump control for starting and stopping pumps discharging out of a wet well. It is practical and dependable for either raw sewage or clear water—wherever accurate control of level is required.

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An authoritative yet simple treatment of the subject by one of the nation's foremost authorities. Mr. Hardenbergh's editorial and field work has brought him in close contact with the problems that trouble the average engineer and in this book he explains those methods most suitable for general use. Special attention is paid to sewerage systems both storm and sanitary. Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods.

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Where Does It Go From Here?

63. That is the title of new 12-page booklet, D 930, with thorough discussion of garbage disposal by sanitary landfill method. Read the latest report from the experts. Caterpillar Tractor Co., Peoria, Ill., or check card.

Versatility, Compaction Force

Account For Extra Packer Capacity

139. The many advantages of this modern packer unit have been combined into a fact-filled bulletin entitled "The Big Squeeze" which is available from E-Z Pack Div., Hercules Gallum Products, Inc., Gallon, O.

Load-Packer 600 Points the Way

to the Best in Refuse Collection

188. Bulletins W-200, W-220 and W-221 explain how the Gar Wood Load-Packer gives faster operation, bigger payload, more compaction, a larger hopper and more dependable operation. Write Gar Wood Industries, Inc., Wayne, Mich., or check the reply card for full details.

Bulk Refuse Collection

with Super Roto-Can

192. A bulletin describing the bulk refuse system called the City Tank Roto-Can, which provides an unusual flexibility of service and the handling of all types of trash is available from City Tank Corp., Corona, N. Y. Check the reply card.

General Specifications

for Refuse and Garbage Trailers

231. Two bulletins, one on the Pak-Mor 38 cu. yd. tandem axle trailer unit and the other on the Pak-Mor 32 cu. yd. trailer for use with Model GRD Dumpster are available from Pak-Mor Manufacturing Co., Box 14147, San Antonio, Texas. General specifications, power train, operating procedures, maintenance and lubrication and other helpful information are included.

How to Construct

A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 13, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Methods and Benefits

of Sanitary Landfill

409. Information on Sanitary landfill methods, organization and necessary equipment with which to carry out the job is available from the Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis.

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By Filming Your Records

57. Microfilm your records by using the Recordak Microfilmer. Check the reply card or write Recordak Corp., 413 Madison Ave., New York 17, N. Y., for operation, use and price of this machine. Also available is literature on the Recordak Verifax Copier that makes certified copies 15 times faster than typing.

If You are Considering a trustee

for a Bond Issue Check with

Chase Manhattan

236. For details on how a bank serves as trustee for bond issues for any municipal or governmental unit, write The Chase Manhattan Bank, 40 Wall St., New York 15, N. Y.

Monthly Time

and Cost Record Book

249. To assist owners in determining the cost of owning and operating equipment Caterpillar Tractor Co., News Service, Peoria, Ill., has prepared a 24-page monthly time and cost record book. Twelve sets of pages are included on which to record day by day machine expenses for an entire year. Check the reply card for your copy.

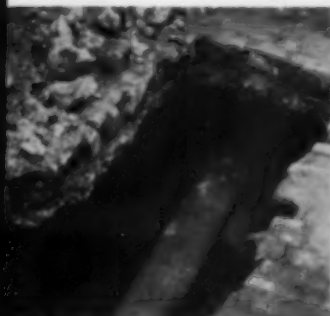
TIME IS THE ^{Only} TEST THAT TELLS



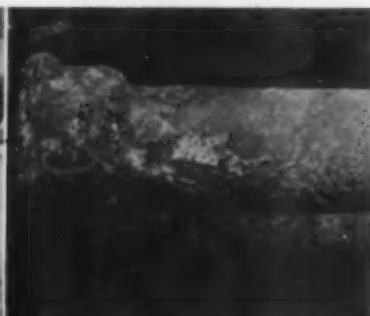
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No other pipe ever made can match this record of long-lived service. Today's modernized Cast Iron Pipe is even more economical and efficient...stronger, tougher and more uniform in quality.

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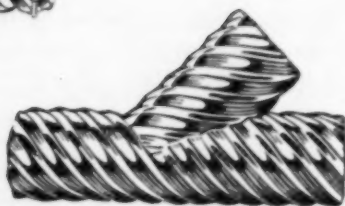
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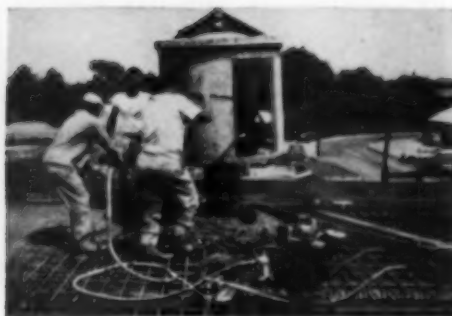
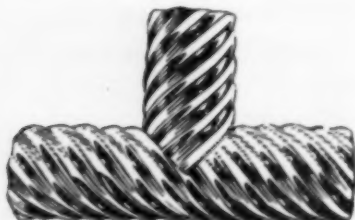
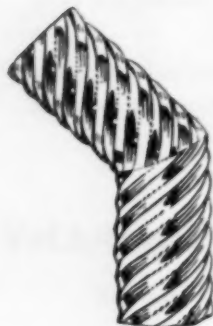


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Subdrainage performance standards move up a mark with the introduction of new Republic Lok-Cor . . . the double lock seam corrugated subdrainage pipe.

Lok-Cor . . . so dependable it can be installed for removal of ground water with complete assurance that the system will function indefinitely without maintenance. It's there to stay. Put Lok-Cor under shifting loads, or under severe freezing

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Check over the many other quality features (see list below) that make Lok-Cor the new leader in subdrainage pipe. Then look for the double lock seam the next time you buy subdrainage. Send coupon for complete information, or contact your nearest Republic Drainage Products Distributor.

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engine power

BY CATERPILLAR

It wasn't so much the river as the land that was causing trouble in North and South Meadows—the lowest sections of land around Hartford, Connecticut.

Five miles of dikes restrained the Connecticut River. They offered protection against a river depth up to 45 feet. But this didn't keep the Meadows dry. Excess water falling within the Hartford area drained into these two areas. And the existing pumping stations couldn't handle all the water—they had a total capacity of only 108,000 gallons per minute. They needed to move a minimum of 216,000 gpm.

The situation was serious not only because it involved lives and property, but because Hartford wanted to develop North and South Meadows as Industrial Park Zones in order to bring new industry into the area.

The Caterpillar Dealer Engine Specialist worked closely with the city to solve the problem—with the help of Cat Diesel Engines. By installing 10 Cat D397 Diesels to drive the existing pumps at higher speeds, Hartford was able to boost pumping capacity to 375,000 gpm, which gives them a comfortable factor of safety.

Wherever you need a supply of power—mechanical or electrical—that you can count on day in and day out, in any emergency, select a Cat Diesel or Cat Electric Set. They are easy to operate, require very little maintenance, are simple and sturdy in design. Write for more details and free literature. Or call in the local Caterpillar Dealer Engine Specialist.

Cat Engines solve Hartford's flood problem

Flood control makes possible new industrial area



THE CITY IS SAFE behind solid dikes that keep the Connecticut River in its place. But excess runoff behind the dikes must be pumped out of the lowest areas and into the river. Pumping has to start when the river reaches 8 feet. Dependable Caterpillar diesel power handles the job and keeps industry dry.



10 WORK LIKE 21. 10 powerful Caterpillar Diesels, like these (engines to left and right in photo), pump over 3 times as much water as 7 engines previously used on the same dikes. They solve Hartford's problem of keeping a new industrial area free from flooding. Dependable Caterpillar Engine Power (center engine) is used to provide standby electric power, too, to operate air compressors, floodgates, lights, heating and other services.

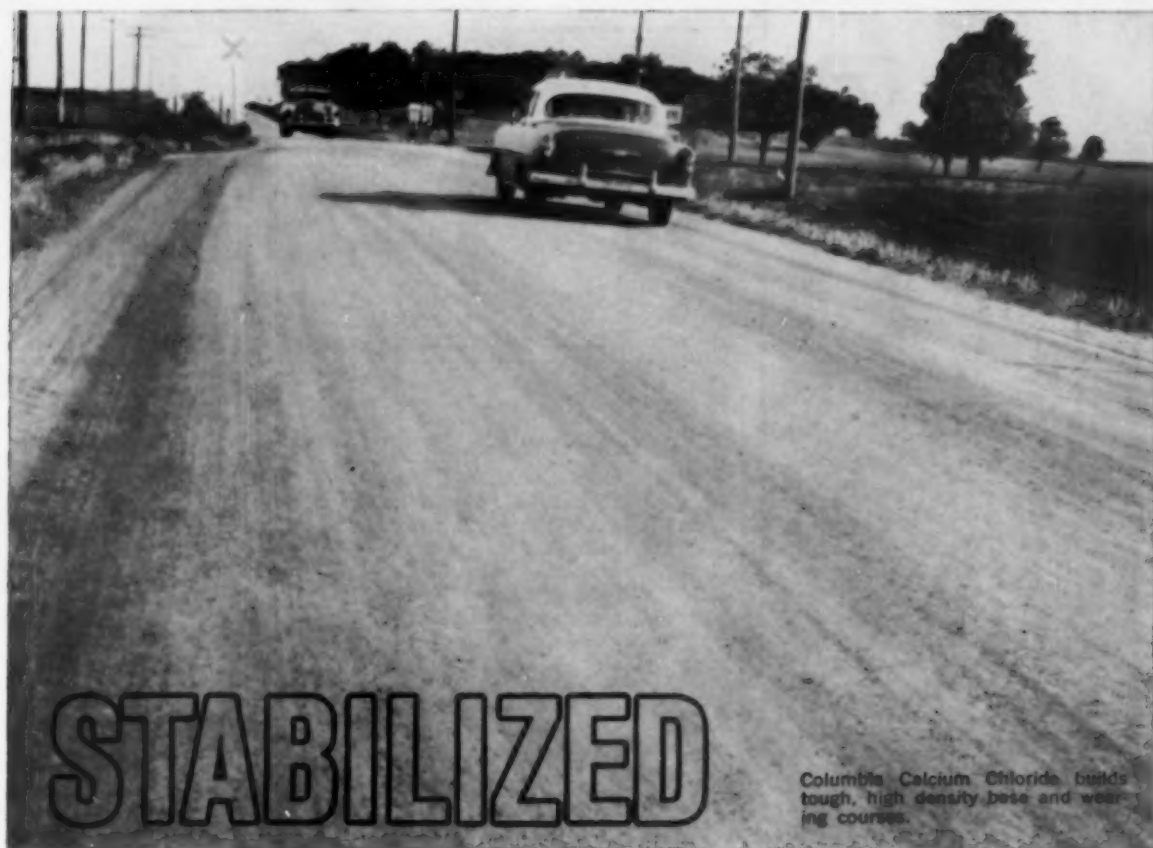
Engine Division, Caterpillar Tractor Co., Peoria, Ill., U. S. A. Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

KNOW HOW. Your Caterpillar Dealer Engine Specialist will help you select the right equipment and help you with installation.

LOW FUEL COST. Caterpillar Engines don't require expensive diesel fuels, work fine even with No. 2 furnace oil. They burn fuel more completely, to save you money.

MORE POWER. Turbocharging, available on most Cat Engines, gives you more horsepower per pound of weight ... improves engine efficiency.





Columbia Calcium Chloride builds tough, high density base and wearing courses.

with Columbia Calcium Chloride

What makes a good road? The answer starts with a durable, dense-graded aggregate base stabilized with Columbia Calcium Chloride. The addition of Columbia Calcium Chloride gives these significant effects on stability:

1. **UNIFORM MOISTURE CONTROL DURING COMPACTION** — Even during periods of low humidity and high temperature, Columbia Calcium Chloride resists evaporation and permits maintenance of optimum moisture during compaction, thus giving higher and more uniform density.
2. **LESS COMPACTIVE EFFORT REQUIRED** — Tests show that by using Columbia Calcium Chloride, greater density can be obtained with one-half the number of rollings.
3. **LESS BINDER REQUIRED** — Reduces the percentage of binder soil required, an important consideration in controlling frost damage.
4. **CONTROLLED CURING FOR INCREASED STABILITY** — Columbia Calcium Chloride assures high structural stability because it controls drying rate during compaction and curing periods.
5. **DUST FREE SURFACE** — Keeps road firm during and after construction, establishes a smooth-riding, safe-wearing surface.
6. **FROST PROTECTION** — Effectively reduces detrimental frost action.
7. **ADAPTABLE TO BOTH PLANT AND ROAD MIXES**
Put Columbia Calcium Chloride to work on your roads. It adds extra miles of trouble-free performance in bases and wearing courses. For more information, contact our nearest District Office or write our Pittsburgh address.

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LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Diversion of Waters

Armbruster v. Stanton—Pilger Drainage District, 100 N.W. 2d 781, a Nebraska case decided Jan. 15, 1960, was an action for diversion by the drainage district of waters flowing in a creek, causing damage to the plaintiff's lands by erosion.

In 1950 defendant constructed the ditch over right-of-way acquired by it for the purpose of straightening the Elkhorn River channel and to provide for the passage of waters which would otherwise have flowed through the old Elkhorn River channel. The ditch was constructed from west to east and then from east to west until it intersected or cut across the channel of the creek on land of another about 990 feet north of plaintiffs' north line. The ditch was cut about 6 feet below the base or bed of Cedar Creek and the Elkhorn River, which created a waterfall 6 feet high where defendant's ditch intersected the creek, and the water therefrom emptied into the ditch. The evidence was conclusive that the waterfall caused the channel of the creek to substantially erode upstream in the creek, thus deepening and widening the creek and continuing to do so until it reached and entered plaintiffs' land, and caused damage to plaintiffs' land and to plaintiffs' improvements and structures on their land.

Before such erosion caused by the waterfall had reached plaintiffs' land, and before any material damage had been caused on their land, plaintiffs notified defendant of the apparent progressive damage which had already manifested itself on the land of another north of plaintiffs. However, although there were and are standard, practical, feasible, and effective structures and methods by which defendant could have arrested and prevented the damage to plaintiffs, defendant has failed to

employ any such methods. The erosion created a broad deep hole on plaintiffs' land for about 200 feet. Plaintiffs, on three different occasions, built piling structures in an effort to stop the erosion, but each of these was washed out after a heavy rain. The cost of these three structures was over \$7000. There was evidence that the defendant could build a standard structure in the creek, which would stop the erosion. Since the banks of the creek were continually dropping off and approaching one of the plaintiffs' sheds and tenant houses, they sought an injunction.

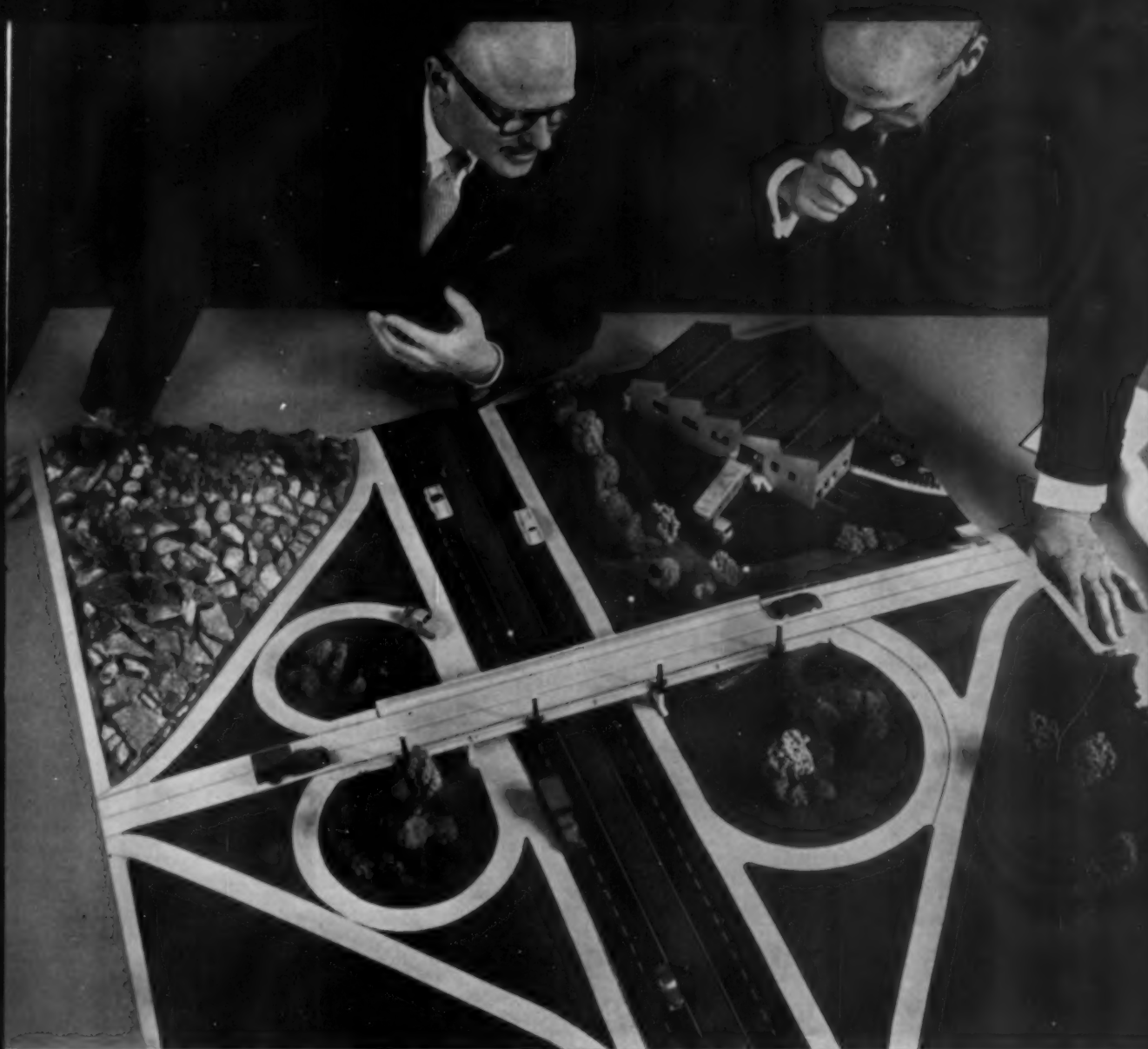
The court held as follows: The evidence in this case is overwhelming that defendant's actions have caused plaintiffs great and irreparable damage; that the creek has not stabilized and will not be stabilized for several years; that the erosion and damages are continuing and will continue over a period of years throughout plaintiffs' land unless a preventive structure is built by defendant to prevent further erosion and damages; that such a structure is standard practice and effective to stop the erosion and damages; and that plaintiffs should be granted a mandatory injunction requiring defendant to build such a structure.

Lowest Responsible Bidder

Day v. City of Beatrice, 101 N.W. 2d 481, a Nebraska case decided March 4, 1960, was an action by an unsuccessful bidder on a city contract for the collection and disposal of garbage.

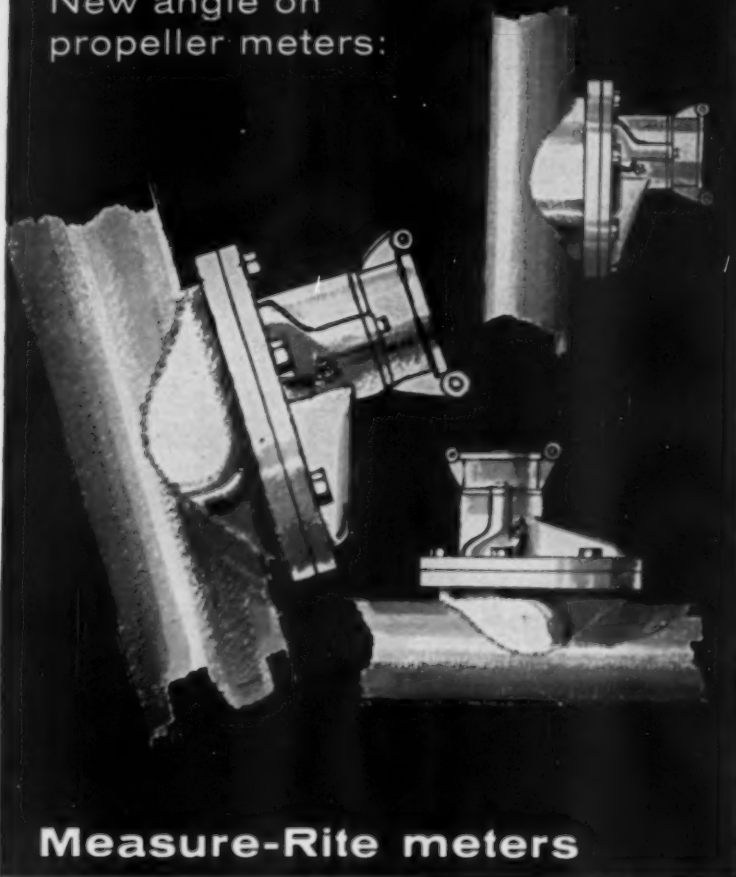
Among the issues raised was the question whether the plaintiff was entitled as a matter of law to be declared the lowest responsible bidder.

The nature of the contract required that bids be made on various



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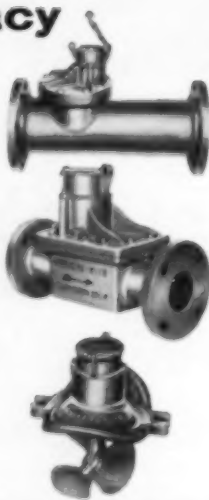
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phases of the operation of collecting and disposing of garbage. The city was required to pay for the operation of the sanitary land fill in securing the burial of garbage, rubbish, and trash. Plaintiff bid \$500 a month on this item, while Vicar (the successful bidder) bid \$400 a month. On the other hand, plaintiff bid \$1.50 a month as the customer charge for the collecting of garbage with a reduced charge of \$1.25 a month if paid by the 10th of the month; while Vicar's bid was also \$1.50 a month as the customer charge with a reduced charge of \$1.35 a month if paid by the 10th of the month. The proposed bids provided for an alternative bid for the disposal of the garbage if the city at some future time installed an incinerator. Plaintiff bid \$300 a month if this alternative operation came into existence; while Vicar made no bid on the alternative.

The court held that, under the circumstances, the city council had discretion to determine which was the lowest responsible bidder and that there was nothing to show fraud, collusion, or favoritism on its part. Therefore, plaintiff's complaint was not allowed.

Break in Sewer Line

City of Elkhart v. Slabaugh, 163 N.E. 2d 583, an Indiana case decided Jan. 7, 1960, was an action by a landowner against the city for damages because of a break in the main line of one of the city sewers, resulting in stoppage of drainage from the owner's land. The property owner himself repaired the sewer, which was 18 feet under the city street, and sued for \$757.35 damages, which was the cost of the repair, contending that the sewer was negligently constructed 45 years before.

The court held, however, that there was no evidence that the city knew of the faulty condition or that any facts existed from which the city should have known of the faulty condition which would have placed a duty upon it to make the repair. Therefore the judgment in favor of the property owner was reversed, as contrary to law.

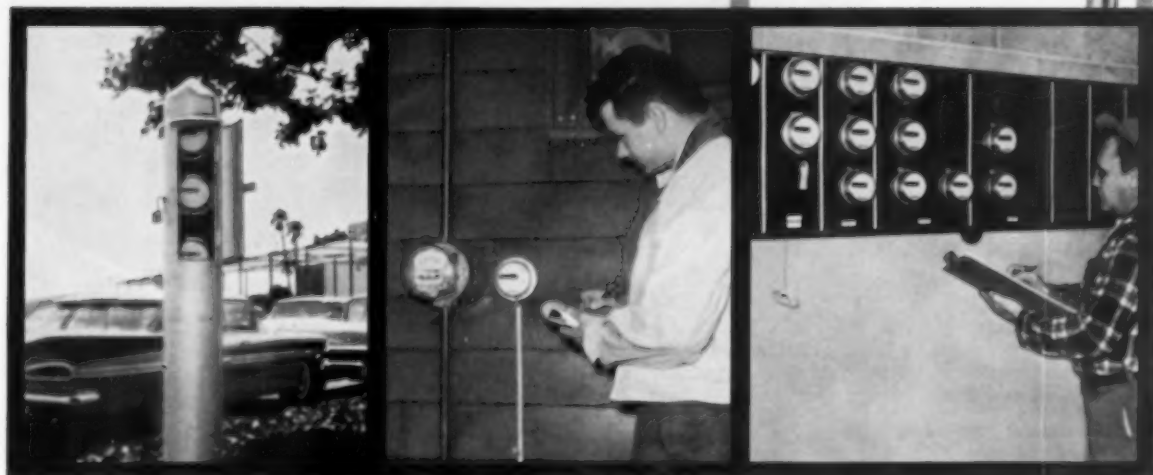
• • •

Cost of Cutting and Clearing

During the 1957 fiscal year, the Illinois Division of Highways spent \$3,485,844 for cutting and clearing vegetation, or \$241.83 per mile, representing 14.12 percent of the total maintenance and operating costs for the State Highway System.

PUBLIC WORKS for June, 1960

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*Read-o-Matic's**
 cost-cutting story is
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*Pat. applied for in U.S.A.
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All over the country water departments are cutting meter-reading costs and increasing efficiency with Badger Read-o-Matic outdoor meter-registers.

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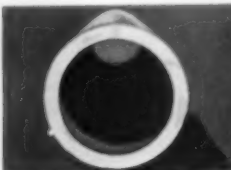
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Permanently smooth bore keeps pumping costs low. Provides excellent flow characteristics.



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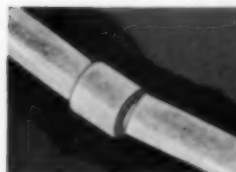
In planning your system, you can build on flatter grades with **"K&M" Asbestos-Cement Sewer Pipe**. Need fewer lift stations. The permanently smooth bore of **"K&M" Asbestos-**

Cement Sewer Pipe has a Manning factor of $n=0.010$. Flow characteristics are excellent. Inspections and treatment loads become less frequent.

This thriftiness carries over into installation. Neither weather nor soil conditions need hold up work. The **"K&M" FLUID-TITE** Coupling slides on in just two easy steps. Longer pipe lengths minimize the number of joints.

Write today for more detailed and illustrated information on hardy **"K&M" Asbestos-Cement Sewer Pipe**. Learn why thousands of progressive communities have turned to this durable quality pipe. Write to: Keasbey & Mattison Company, Ambler, Pa., Dept. P-760

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Bulletin 1870-A.



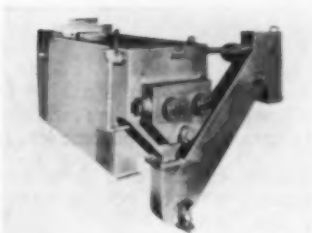
Dry Feeders... Type E provide automatic proportional or constant rate feeding. The feeder with linear feed adjustment throughout capacity range of feeder; extrusion type, simultaneous rocking and reciprocal motion of feed pan.

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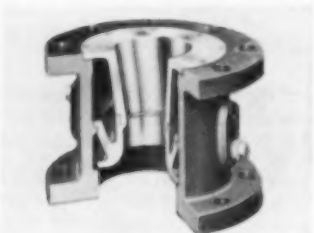
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Bulletin T021.



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No operating maintenance! All Oriseal Valves tested required no periodic maintenance. Some Oriseal Curb Valves were cycle tested under pressure as much as 45,000 times without service attention of any kind.

If you would like the complete test reports on the Oriseal Valve, please write to Mueller Co., Decatur, Illinois.

Oriseal design features add new benefits to the "plug valve"

The Oriseal maintains the advantages of a plug type valve, yet is easy to operate, does not require lubrication or periodic maintenance and needs no mechanical means of seating.

The Oriseal is a sturdy quarter turn valve. The position of the tee head

readily indicates whether the valve is open or closed. Even though the valve is hidden or otherwise inaccessible, the open or closed position is always easily determined.

There are no small parts to twist or break — no stem to bend — no threads to strip.



Check these Oriseal design features ... they offer curb stop advantages not found in any other type valve.



FULL ROUND WAY—permits rodding and pipe cleaning operations.

STRAIGHT THROUGH FLOW—no obstructions—almost no pressure loss.

PROTECTED SEATS—in open position seating surfaces are covered and protected from the flow of the fluid.

TOP AND BOTTOM "O" RINGS—positive pressure sealing without mechanical means—tend to cushion the plug.

STRAIGHT, BALANCED PRESSURE PLUG—top and bottom "O" rings are of equal size eliminating end thrust—contributes to ease in turning.

PORT "O" RING—functions in a specially designed "O" ring groove located in the body around the outlet port. This design provides the maximum support for the "O" ring—eliminates major causes of "O" ring damage—results in the proper "O" ring seating action—gives positive pressure sealing and long cycle life.

TEFLON COATED PLUG—surface of the plug is coated and impregnated with Teflon, which is an inert material with a very slick surface. Teflon assures easy turning—eliminates "sticking" or "freezing" even after prolonged idleness.

STRONG CAST BRASS BODY—designed with extra strength and sturdy check lugs to withstand all normal operating and installation stresses. The ORISEAL body has withstood extreme laboratory stress and pipe bending tests, as well as field test conditions.

NO LUBRICATION OR PERIODIC MAINTENANCE—if necessary, the valve can be completely reconditioned in the line. Simply remove the base cap—slide out the plug—replace the "O" rings—and reassemble the plug and base cap.

MUELLER CO., DECATUR, ILLINOIS



ORISEAL CURB VALVE *Specifications*

Full Round Way Opening — unobstructed passageway
Solid Tee Head — $\frac{1}{4}$ " hole for attaching stationary rod
Quarter Turn with Check

Opening by turning to the left (counter-clockwise)

125 p.s.i. Water Working Pressure

125 p.s.i. Test Pressure — Every Oriseal Valve is fully tested in both the open and closed position with 125 p.s.i. air pressure under water. This is a much more exacting test than a hydrostatic test.

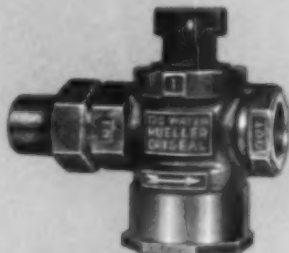
150° F. Maximum Water Temperature Rating
Sizes — $\frac{3}{4}$ ", 1", 1 $\frac{1}{4}$ ", 1 $\frac{1}{2}$ ", 2"

Oriseal Valves comply with all applicable parts of the following specifications:

AWWA	C800-55
ASTM	B-62-52 (85-5-5-5)
ASA	B16.15-58
ASA	B2.1-45



H-10291: Oriseal Curb Valve
Inlet: Inside I.P. Thread
Outlet: Inside I.P. Thread



H-18176: Oriseal Curb Valve
Inlet: Mueller Copper Service Pipe Connection
Outlet: Inside I.P. Thread



H-18201: Oriseal Curb Valve
Inlet: Mueller Copper Service Pipe Connection
Outlet: Mueller Copper Service Pipe Connection

Mueller Improved Curb Boxes with either stationary or separate shut-off rods are available: H-10385— $\frac{3}{4}$ ", 1" valves; H-10386—1 $\frac{1}{4}$ ", 1 $\frac{1}{2}$ ", 2" valves

a word about Teflon

Teflon is a chemically inert neutral substance with no toxicity or taste.

It has been approved for use in food processing and food handling. Teflon is one of the most chemically and corrosive resistant materials known.



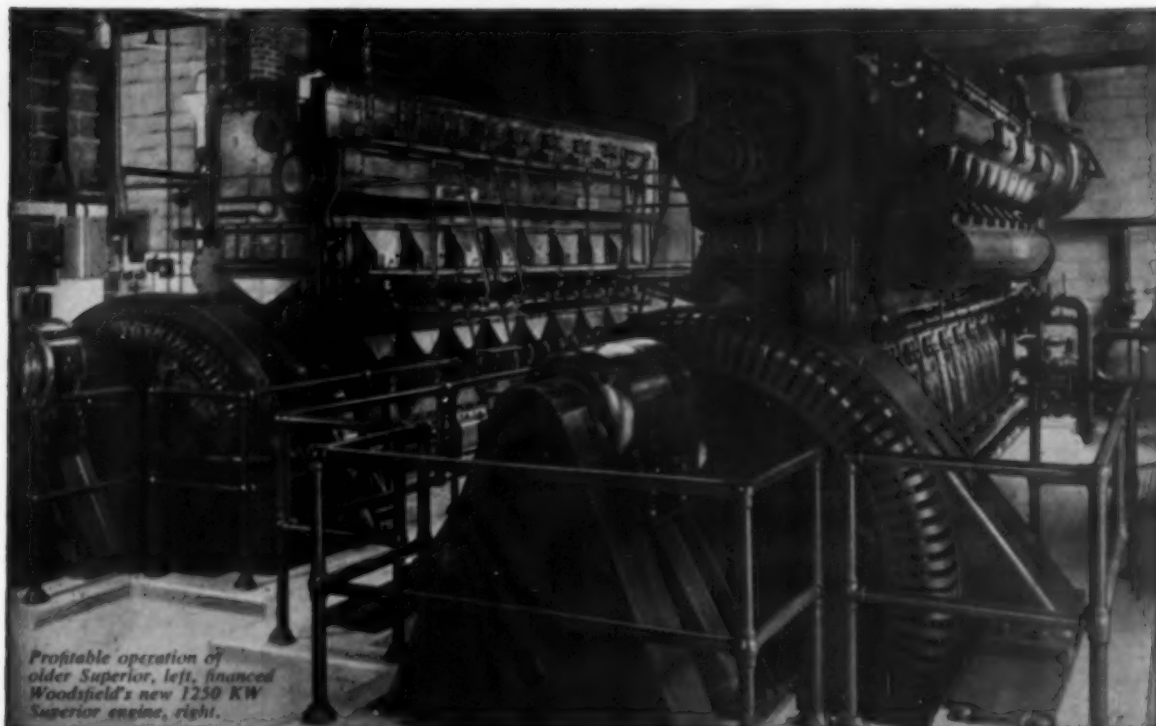
If you have experienced curb stops "sticking" or if you are using gate valves in place of large size curb stops, test an Oriseal Curb Stop and be assured of its easy turning qualities.

Write today or see your Mueller representative.



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DECATUR, ILL.**

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Profitable operation of older Superior, left, financed Woodsfield's new 1250 KW Superior engine, right.

80-GDS-8 runs 44,000 hours without overhaul, cuts fuel cost 50%, pays for second diesel!

Superior engines power Woodsfield's boom!



White Diesel

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY

Plant and General Offices: Springfield, Ohio

L. W. Marple, plant superintendent, checks controls
of town's five power-producing engines.

Olin Mathieson's new aluminum plant on the Ohio River, 18 miles from Woodsfield, caused the town to grow more during 1957-59 than in the previous 25 years combined! Power consumption soared from 2,921,740 KW in 1956 to 4,167,260 KW in 1958, as acres of new worker homes hit the line.

But economy-minded city fathers and maintenance-conscious power plant personnel met the crisis, aided by two Superior engines. The first, an 80-GDS-8 dual-fuel of 600 KW capacity, entered service in 1950. During the next 7 years, it reduced costs per KWH 50% as compared to Woodsfield's 3 older straight diesels. After 44,000 hours operation, it was overhauled in 1958. The only replacements needed were connecting rod bearings. Piston rings were replaced, too, although their .002" wear was well within tolerances.

This Superior did more than supply consumers with low-cost electricity. Power profits also financed various municipal improvements, including a second Superior engine-generator! The new 80-GDSX-8 supercharged dual-fuel of 1250 KW capacity commenced operation in early 1958. In addition to maintaining low fuel costs, it operates more than 50,000 horsepower-hours per gallon of lube oil!

For every municipal need, White Superior offers economical diesel, dual-fuel, or gas engines ranging from 190 to 2150 HP, or 150 to 1500 KW!



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When you order water coolers, specify IGLOO because:

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- Its recessed spigot won't be knocked off

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IGLOO

Memphis 18, Tennessee



WHAT IS "HIGH RATE" IN BIOLOGIC PROCESSES?

R. S. RANKIN

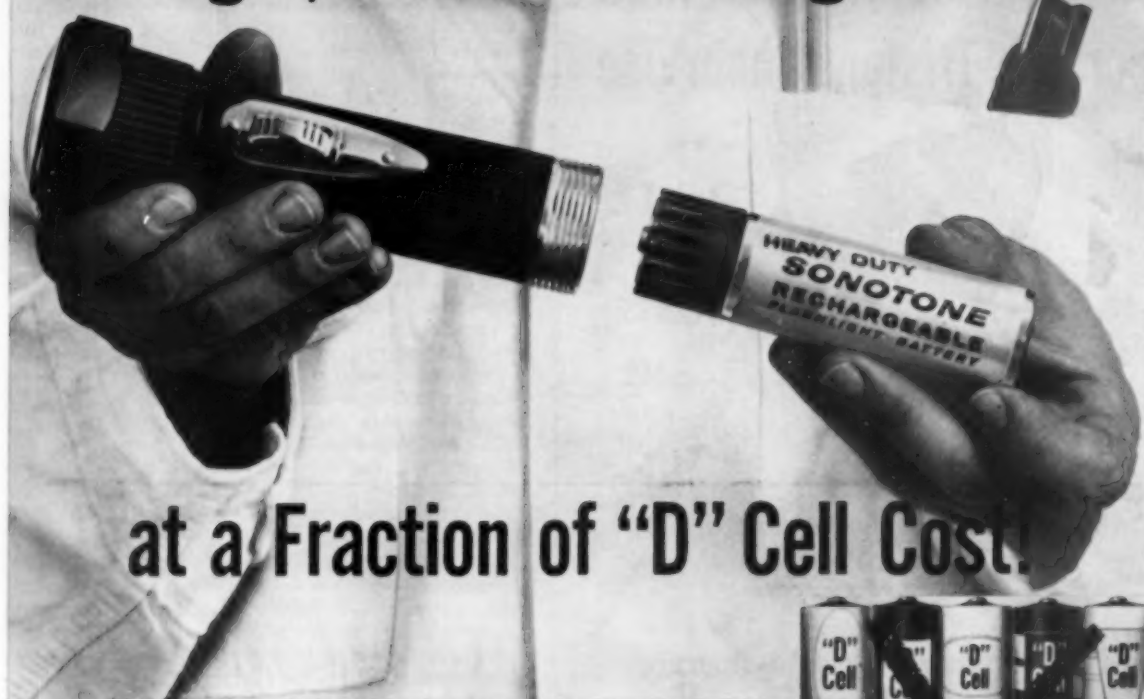
Consultant, Water and Sewage Treatment

IN DISCUSSIONS of sewage treatment, one frequently encounters the term "high rate" applied to various steps. High rate filters, high rate activated sludge, high rate digestion, are typical examples, the implication being that the rates are above those currently deemed acceptable and that there is some question as to their reliability. This becomes confusing because to be considered high in rate implies a standard base or level which has been generally accepted as such. So far as is known there are no permanent bases from which rates of biologic processes in sewage treatment can be measured although some arbitrary bases have been established for convenience by various agencies.

What is meant by the term high rate applied to these biologic processes? It could mean that the basic process has been accelerated, that environment has been physically altered or improved so that more organisms can get in on the job, or that the capability or limitations of the basic process had been underestimated. It seems that the last two reasons are principally responsible for the increased rates frequently encountered in current practice. The biologic ability was there all the time but it remained to be discovered and more efficiently utilized.

If this conclusion is correct, then rates at which biological processes are able to function should be considered temporary so long as some phase remains unexplored. In aerobic processes such as trickling filters, for example, a wealth of operating experience has established many rates which have yielded acceptable results. However, as time has brought increased knowledge the "standard rate" has changed accordingly. During the interval of 1915-1930 the accepted rate of application was 300,000 gal. per day per acre foot; during 1930-40 it had increased to around 500,000 gal. per day per ac.ft. Since 1950, the standard liquid loading has increased to 667,000 gal. per day per ac.ft. This increase of more than 200% in a "standard" does not denote the measure of stability deserved in sanitary engineering standards. Instead of the term "standard" possibly "current acceptable rate" or some term denoting a limit based on present knowledge would be more appropriate.

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Battery Division, Dept. B54-60

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Vise base, that overhangs front legs for clear tool swing, has hanger slots for tools, 3-size pipe bender, rear pipe rest and adjustable ceiling brace screw. Folding legs and integral tray set up easily and lock in position for rigid work base. Snap chain holds folded legs closed for easy carrying . . . no loose parts. Rubber grommets in tristand feet prevent creeping. See and try this more-for-your-money **RIGID** Top Screw Chain Vise at your Supply House!

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Beginning in 1936, "standard" trickling filter practice of that time was disrupted by the entrance of Biofilters and Aerofilters which applied successfully rates several times higher than previously used. Rates of 10 to 25 or 30 mil. gal. per acre per day began to be used and it was discovered that the filters did everything required except produce nitrates in the effluent and in most areas this previous requirement is now considered unnecessary. Any previous standard could no longer lay claim to validity except for historic reasons.

More recently, developments are giving indications that rates of application can be increased considerably beyond the present so-called high rate range which is another way of stating that the ultimate biologic capacity of trickling filters still has apparently not been reached. Ingram (1) conducted tests over an entire year on one filter operating at 159.8 mil. gal. per acre per day, and on a second filter at rates up to 179 mil. gal. per acre per day. Most interesting are the performance results which tend to confirm the belief that the capacity of the trickling filters in the removal of BOD is for the first time being thoroughly explored.

The trickling filter has now been in use for over 60 years and yet the full range of its possibilities are still not thoroughly understood. During its lifetime it has consistently given a good account of itself. Rates of application have increased many times. With a history of such variable rates of usage, it becomes somewhat deceptive to declare any one rate as standard. It lacks the background necessary to qualify it as a standard and disregards the experience of hundreds of prior installations operating at different rates.

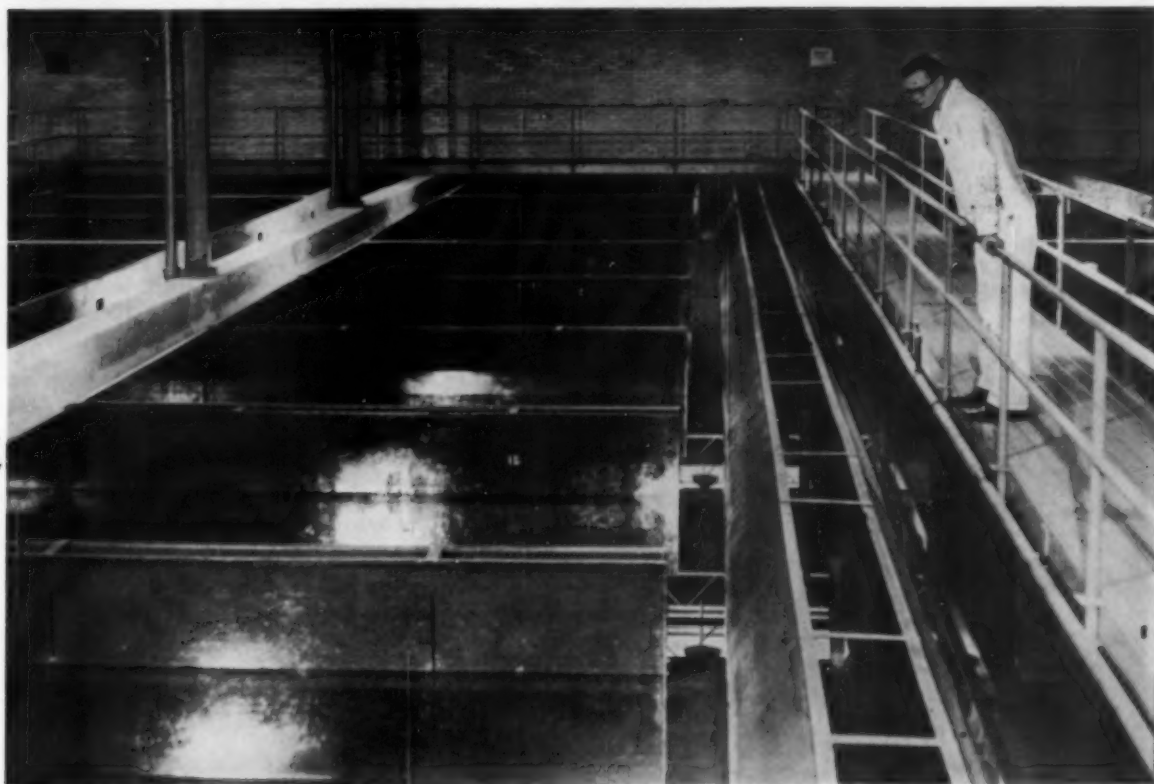
The fact is that the ultimate loading limits of the trickling filter have yet to be defined. Every few years brings new knowledge of its capabilities and it is certain to be many more years before any unvarying standard can be agreed upon. What was high rate one time is now average or low rate, and this situation will prevail as future research discovers more capabilities of this relatively unexplored but versatile tool, the trickling filter.

In the field of anaerobic processes such as sludge digestion, the term "high rate" is being applied more frequently as though some special quality or characteristic of the digester were implied. It is now being applied when the loadings are increased to a level at which the digester contents are displaced in 10 days or less. Does this imply that the biologic process is being speeded up? Considering all factors, there is no evidence that this is the case.

It has long been known that to digest a new charge to a digester in established operation the time required as measured by gas production is less than 24 hours whereas the volume usually provided in digesters was until recently 30 days and upwards. Initially the volume of separate digesters was based on capacities used in unheated Imhoff tanks which in turn had been increased considerably over original European practice. These capacities tended to be generous, particularly when heat was applied, but this was better than any deficiency.

Stirring in digesters was introduced in 1926 mainly as a means of scum control as it made no apparent difference in volume requirements or, in other words, volumetric efficiency was not affected by the type of stirring. Slow stirring was an appropriate description as the usual speed of mixers was one revolution in 25 to 30 minutes. Some years ago, before the ad-

FLUIDICS* AT WORK



SPACE SAVER. Permutit Horizontal Precipitators take only 25% as much space as would be needed by conventional basins at the Town of Tonawanda Water Treatment Plant, Tonawanda, N. Y.

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When the booming town of Tonawanda, N. Y., decided to build its own water treatment plant, space was a major consideration.

The solution as proposed by Nussbaumer, Clarke and Velzey, Consulting Engineers, was to install four Permutit Horizontal Precipitators.

Each unit measures 31'6" x 95' x 16'3" and is designed to handle four million gallons per day with a two million gallon overload. Proved in operation for more than two years, this system efficiently treats 24 million gallons per day.

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Space is just one saving you can make with Permutit Precipitators. You'll also find that treatment efficiency is increased, and that often there's a reduction in chemicals and coagulants required.

If you'd like more information about the efficiencies possible through the use of Permutit Precipitators, write for Bulletin No. 2204C.

Or, for a brief introduction to the full line of Pfaudler Permutit equipment for water and waste treatment, ask for the bulletin entitled "An Outline of Modern Water Treating Equipment." Address your inquiries to our Permutit Division, Dept. PW-60, 50 West 44th Street, New York 36, New York.



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Scum—the problem of ordinary pools—is washed over the coping and out of the pool into properly located skimmer drains. This eliminates hard-to-drain scum gutters above the water line, saves the cost of formed tile gutters and 5" to 10" of excavation and concrete walls.

A few typical water level pool fittings are shown here, but for complete details, plans and pool layouts, send coupon for Manual SP-6, the "authority" on circulation and drainage for all types of pools.

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vent of high capacity mixing equipment, operating data from a number of digesters was collected which showed that volumetric detention of the sludge was the principal factor influencing digester performance as measured by gas production and volatile solids reduction. Many operators confirmed this conclusion at their plants and agreed with the values set forth. What was not recognized at the time was that displacement efficiency in these older plants was very low. The daily sludge addition was insufficient continuously to displace the 45 to 60 days accumulation in these digesters. Tests made since and observations by others indicate the utilization of only about one-third of the tank's volume. In other words, if the tank contents could be completely displaced by stirring facilities as is possible in the laboratory or pilot plant, the actual detention periods would be about one-third of those found in full scale plants.

Since 1950 investigators again began looking into new fields, not necessarily to conquer but to understand better, and digestion was one of these. Several pilot digesters were put into operation and it did not take long to find out that they could be operated on a much shorter time schedule or alternatively at greatly increased loadings. Torpey (2) in his extensive investigations concluded that if effective stirring could be provided, the typical digester could handle three times its previous volume and produce the same results. The value of effective mixing is now recognized by the facilities offered by several equipment companies. In plant scale digesters there is a practical limit beyond which further mixing is of questionable economy. At present a volumetric efficiency of 67% is justified which means a given digester volume can now obtain the same results in half the former time or conversely handle twice the daily load as formerly. Thus increased capacity is not due to increase in the process itself but to providing more room for more workers which in turn consume more food.

These two illustrations of biologic processes used in sewage treatment, one aerobic and the other anaerobic, show that man-made limitations on application rates should not be rigid and unyielding. Obviously, the organisms, unaware of such limitations, may have capacities as yet unknown. Consider the activated sludge process which has received more intensive research than all sewage treatment processes combined, and still new facts are continually being discovered. If a fraction of this attention could be devoted to trickling filters, some surprises might be the result. What is needed in establishing any so-called standard is a flexible understanding based on the principle that biologic processes may be rigid in their functioning yet the applications of the processes are still not fully explored. Thus in the term high rate, improvement simply in application is represented.

References

- (1) An Investigation of The Mechanism of Controlled Filtration, Wm. T. Ingram, Jrnl. of Sew. and Ind. Wastes. Vol 31, 1959, Pg. 1147
- (2) Loading to Failure of a Pilot High-Rate Digester, Wilbur N. Torpey, Jrnl. of Sew. and Ind. Wastes. Vol 27, 1955, Pg. 121

Nationwide Survey of Water Use Planned

The Geological Survey plans to conduct an inventory of water use in the United States in 1960. Demands for water are approaching the limit of the

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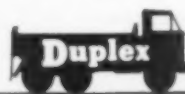


Accurate control of down pressure and bucket wrist action enables Hopto to dig in any material, pry out boulders and rock, and work around other obstructions. One-man operation of the self-propelled crawler or rubber mounted Model 200 is provided by the single power unit for both boom and drive. Interchangeable backhoe and shovel buckets, and other attachments make Hopto the most versatile excavator in its class.

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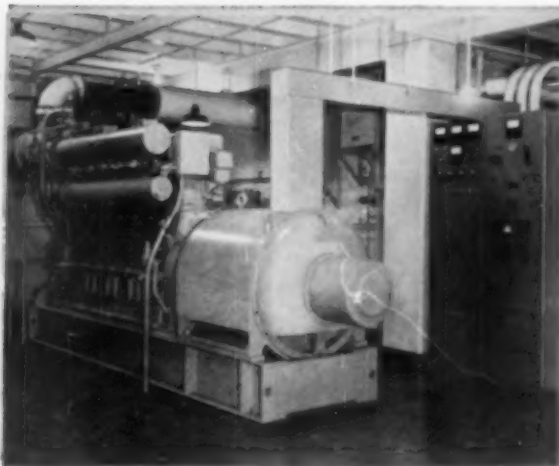
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clean fresh water readily available at all times; however, large quantities of water are still unused because they occur at unwanted times and places.

The new inventory defines the present balance between supply and demand, which becomes more critical as demands increase. The inventory will be made by field personnel as part of their job of investigating the quantity and quality of the Nation's water resources.

Water use will be compiled in six general categories: 1) public supply; 2) self-supplied industrial; 3) steam-electric utility power plants; 4) irrigation; 5) rural domestic; and 6) water power. These data will be tabulated by source—ground water or surface water—and by location of use, as by States and by groups of river basins.

Information on water use collected by municipalities, States, other Federal agencies, associations of manufacturers, irrigation districts and other organizations will be utilized in the study. Upon completion of the inventory, the Geological Survey will publish a report on water use in the United States, probably by the end of 1962. Preliminary data will be available prior to that time.

The last previous report on this subject, U. S. Geological Survey Circular 398, stated that an average 240 billion gallons a day of water was withdrawn during 1955 for the Nation as a whole, equivalent to about 1,500 gallons per person.

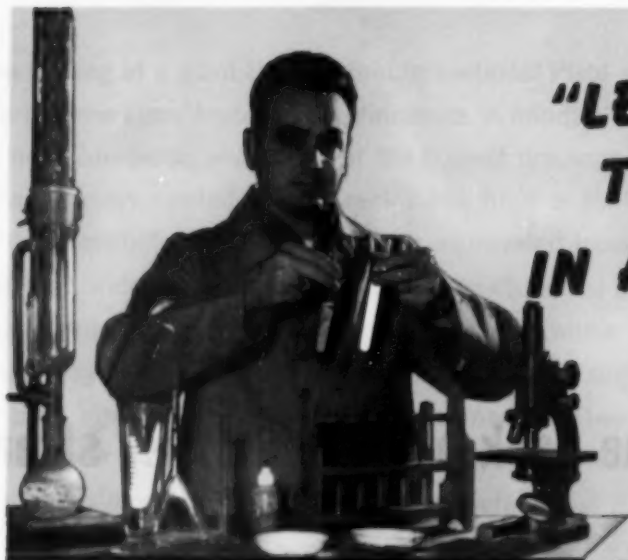
Refuse Collection and Disposal Costs and Related Data

The average cost for garbage collection and disposal in Fort Worth, Texas, for the 1959 fiscal year was \$5.69 per ton. This compares with \$5.91 and \$5.98 for the two preceding years. Of the 1,883,117 cu. yds. of garbage disposed of, 1,131.87 cu. yds. were incinerated; landfills and a dump provided disposal for the remainder. During the year 116 collection vehicles were used, 12 of which were extras. Average loads per day per truck were 4.27. Of the compactor type trucks, 20 are 12-yd., one is 13-yd., nine are 15-yd. and seven are 16-yd. In addition there are 79 open body trucks of 12 and 14-yd. capacity.

Salvage operations, which netted \$5,812.97, produced 116,310 pounds of rags, with net to the city of \$758.86; 372,350 pounds of paper, with net of \$385.60; and miscellaneous salvage with net of \$4,668.51.

Power Production at a Sewage Treatment Plant

Four diesel-electric power units were installed at Cincinnati's Mill Creek sewage treatment plant, providing 5,400 kw. Through the first half of 1959, the power plant was scheduled for limited, intermittent operation, with operating personnel limited to but two enginemen. As the year progressed, additional manpower was employed, trained and so scheduled that, by September, the power system was manned for round-the-clock operation. Late in October, the plant regularly served the project with electric power during the daytime, while purchased power was more economically distributed at night. By November, the power system remained in continuous operation, serving Mill Creek Sewage Works with all its electrical needs. Electrical production for the year totalled 1,576,000 kilowatt-hours. Moreover the power plant transmitted an almost equal amount of energy in the form of heat, for process work elsewhere in the treatment plant.



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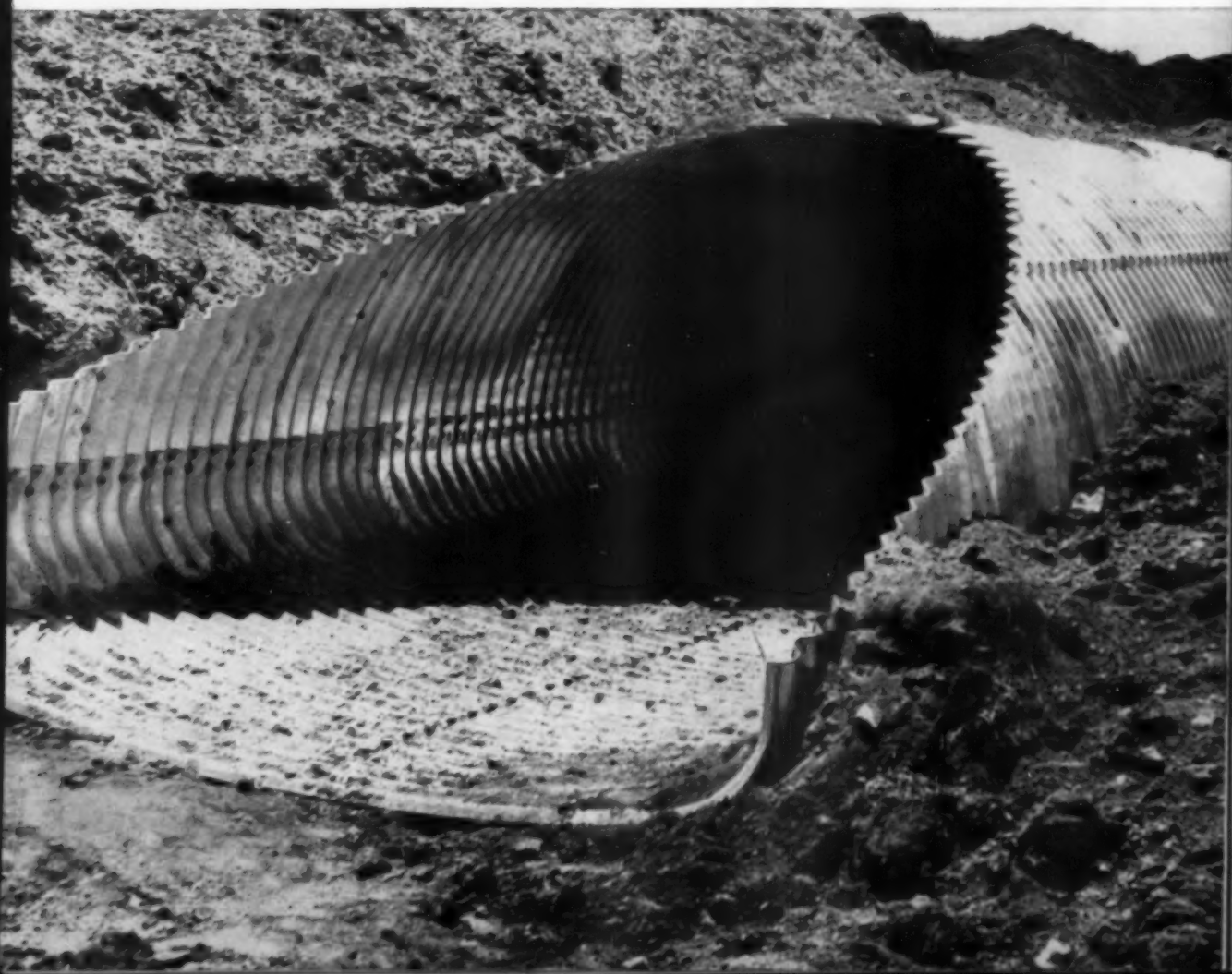
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□ After a heavy rainfall, Bitter Creek turns from a gentle, slow-moving stream into a raging torrent of destruction. Flash floods have aggravated local townsfolk and farmers for years. But in this new, wide-mouthed sectional plate structure, the water simply runs itself out. □ The huge drainage structure is one of four recently installed within a 10-mile area as part of a new four-lane highway system. The other three structures are slightly smaller. USS AmBridge Sectional Plate pipe, pipe-arches and arches are permanent. They won't crack. Won't break. And installation is faster, because there's no need for forms. Write or contact any one of our offices for information on *American Bridge Highway Products*.

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"THE NEW No. 12E HAS A LOT OF IMPROVEMENTS. PLENTY OF POWER FOR ANY JOB. SHIFTS AS EASY AS A CAR. STEERS AND HANDLES BETTER THAN ANY GRADER I'VE EVER OPERATED."

Irvin Williams, Equipment Operator, Street Dept., Rolla, Missouri



The economical record of Caterpillar equipment owned by Rolla convinced the city officials to purchase a new No. 12E Motor Grader. It will be used for cleaning ditches, mixing and laying road material on the city's 50 miles of streets.

Operator Irv Williams and Superintendent of Streets Bill Carroll are both enthusiastic about their new Cat Grader. But then that's understandable because the new No. 12E really is out front in Motor Grader performance.

Here are a few of the reasons: A new, compact engine provides greater lugging ability in tough going. It's designed for long life and easy servicing. Horsepower rating is still 115, but this new engine develops higher torque and gives the No. 12E greater load-handling capacity. A new two-cylinder vertical starting engine replaces the horizontal type, providing positive in-seat starts in any weather. The dry-type air cleaner is now standard, too. It removes at least 99.8% of all dirt from intake air, cutting maintenance time by as much as 70%.

Retained features that keep operating and maintenance costs to a minimum are: the exclusive oil clutch which provides up to 2,000 hours without adjustment; big clearance between the top of the moldboard and the bottom of the circle drawbar; and improved, anti-creep mechanical controls.

These are just a few of the reasons why the No. 12E is a better investment for your tax dollar. For the complete picture see your Caterpillar Dealer. A demonstration will specifically show you how the new No. 12E pulls through the tough going!

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

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**BEST BUY FOR
YOUR TAX DOLLARS**

SEWAGE TREATMENT PLANT

TO BE FUTURE PUMP STATION

PUBLIC
WORKS
Magazine

JUNE, 1960

Volume 91, Number 6

WILLIAM J. CHASE

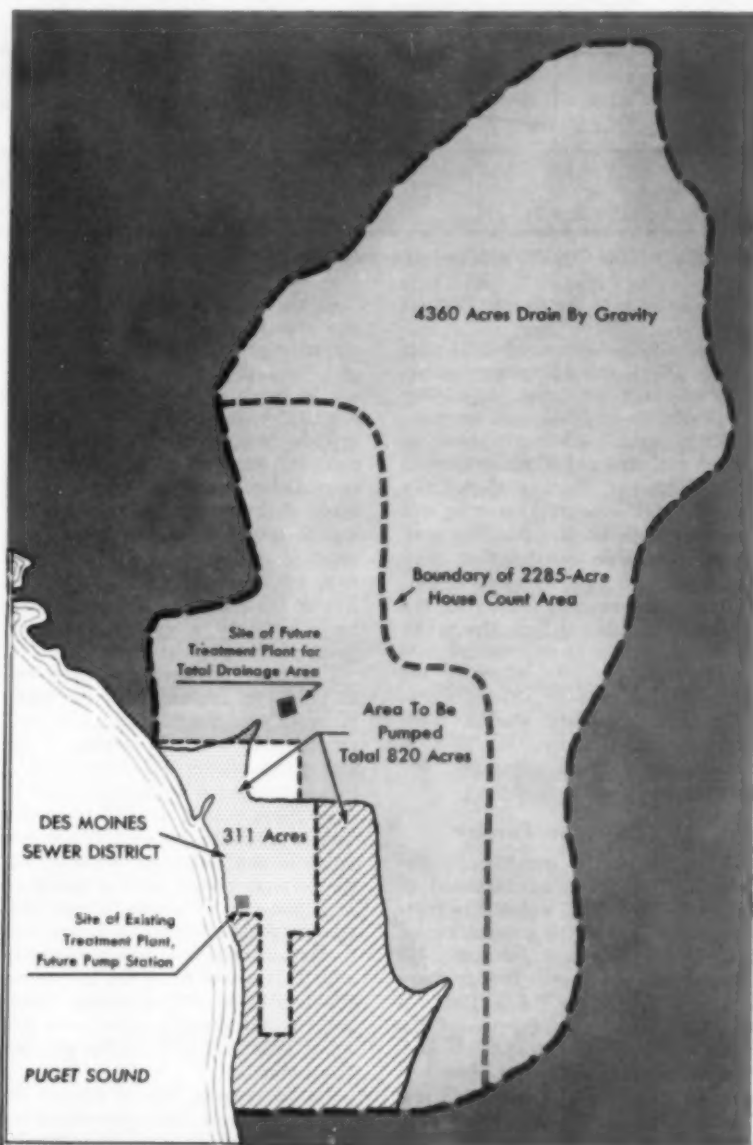
Partner,

Hill & Ingman, Consulting Engineers,
Seattle, Washington

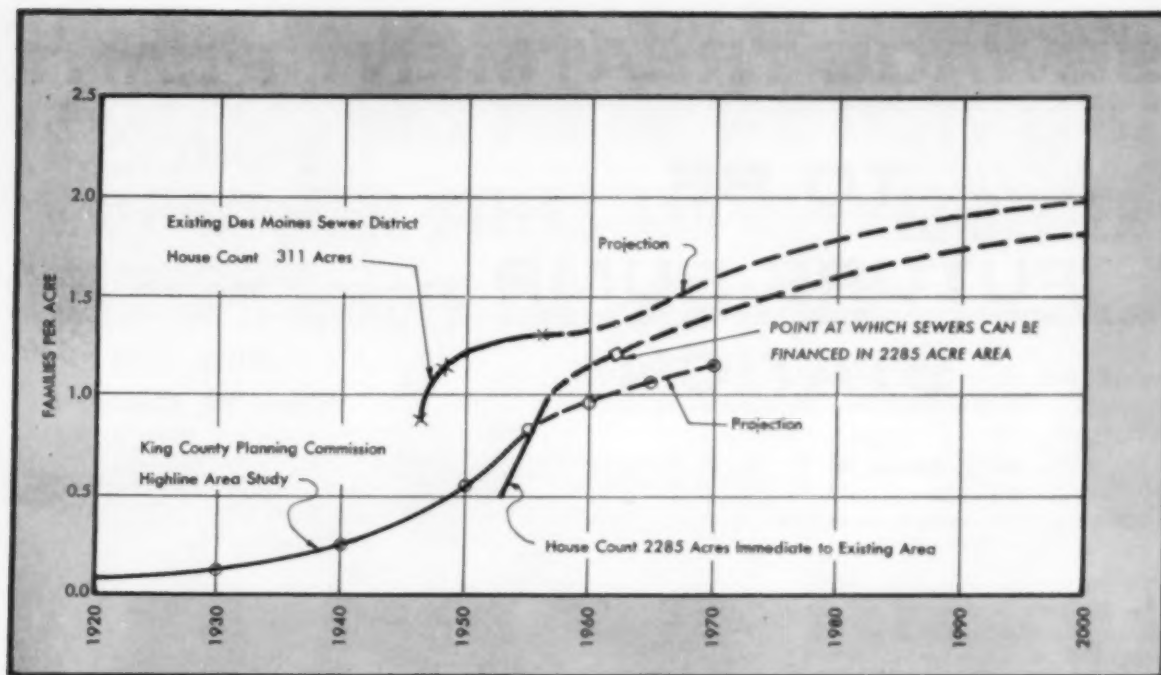
TO PROVIDE sewage treatment to a 311 acre area occupying one corner of a 5,180 acre drainage pattern with a minimum of future duplication or waste was a significant problem for the Des Moines Sewer District, South of Seattle, Washington, on Puget Sound. To make the problem more difficult, the focal point of the drainage from the 300 acre area was approximately one mile South of the most desirable treatment plant site for the ultimate 5,100 acre drainage pattern.

Located approximately 8 miles South of the South City Limits of Seattle, Washington, the Sewer District is adjacent to Puget Sound. The drainage pattern of the District is away from the Seattle area and from any Seattle Metropolitan facilities. Thus, the area had to be treated separately from the Metropolitan system and, therefore, was faced with the requirement of financing their own facilities. Though the critical area was only 300 acres in size, the failure of septic tank drainfields in the hardpan soil created a dire need for sewers.

Spearheaded by community club efforts in the drive for sewers, the Des Moines area called for an election on July 16th, 1946, at which time the Des Moines Sewer District was born and commissioners elected. The original Commissioners elected were Harry P. Draper, Chairman, Jack N. Bryant, Secretary, and Bert Markwell. During the construction period those offices were held by R. L. Moss, President, Harry Draper and Maebyn Miles, Secretary. Presently, the commissioners are R. L. Moss, President, Joseph Stockdale, Secretary and Delbert Parsons.



● MAP SHOWS relationship of Des Moines Sewer District to entire 5,180 acre drainage pattern. Red shaded area will require pumping to the ultimate plant site.



● POPULATION CURVES with projections used to predict development of the Des Moines Sewer District and surrounding area.

W. D. Beattie is the Sewer District Manager.

With the retention of Hill and Ingman, Consulting Engineers, engineering and financial feasibility studies were carried out, encompassing several alternate possible sewer systems and their estimated costs. However, these studies indicated that the population was still too sparse to enable the financing of a reasonable construction program.

During the ensuing few years, the march of population from the urban to the suburban areas reached new heights. As the population in the Des Moines Sewer District grew, additional feasibility studies were carried out. Finally, in 1956, a reasonable financial program appeared feasible.

The Drainage Pattern

As previously mentioned, the overall drainage area consisted of approximately 5,180 acres. The relative elevations of the ground varied from sea level to approximately 400 feet above sea level. The primary drainage course for the majority of the area has its confluence at the mouth of the stream near the Northwest corner of the District. However, due to residential construction and limited suitable space in the area, the most feasible ultimate plant site for the drainage pattern was determined to be approximately one-half mile upstream. About 85 percent of

the entire 5,180-acre area can reach this site by gravity. However, the majority of the present population, and thus the Sewer District, was not included in the 85 percent and sewage from within the District would, therefore, have required pumping approximately one mile to such a plant site. Approximately 820 acres of the entire drainage pattern would require pumping, with 311 acres of the 820-acre drainage pattern actually comprising the official Sewer District. The 820 acres drain by gravity to a generally central point of the present Sewer District.

The final problem was thus resolved to an evaluation of the feasibility of two alternatives: (1) construction of a pump station at the low point of the 820 acres with a force main to a treatment plant at the ultimate site; or (2) construction of a treatment unit at the low point of the 820 acres which could be later converted, with a minimum of duplication or waste, to a lift station to pump through a force main to the ultimate final treatment plant site. This would solve the immediate problem of providing sewage treatment to the small original area and a pumping structure for the ultimate development.

In either case, lateral sewers designed to serve the present district and the trunk to serve the remaining portion of the 820 acre area would be permanent facilities essentially unaffected by the plant loca-

tion, because in the future sewage would be pumped from the low point of the 820 acres to the ultimate treatment plant site North of the then existing North boundary of the sewer district.

It was obvious that the population in a 311 acre area could not finance a treatment plant to serve the ultimate 5,100 acre drainage pattern. It was also evident after study that the 311 acre area could not afford a pump station at the low point, the 1-mile force main, plus even a first stage treatment plant at the ultimate site and the long outfall from there to Puget Sound. To establish feasibility of alternative (2) the problem then was first to establish the population for which the first stage treatment plant should be designed at the low point of the 820 acres.

The Commissioners and Engineers realized that once sewers were available in a nucleus area, home construction within the District and in the areas surrounding would occur at an increasing rate and probably result in rapid annexations. This was the proven case in nearly every other sewer district in this area. Nominal size areas were available in which builders could construct from 10 to several hundred houses. In those situations, the land developer, under supervision by the District, constructs all sewers and upon their completion, deeds them, free and clear, to the utility district.



● TREATMENT PLANT which presently serves the Des Moines Sewer District. This will be converted to a pumping station.

Service charges comparable to the rates charged other houses in the District are charged to the new houses and result in substantial increased income to the Sewer District. Since the sewers in those areas have been donated to the District, the service charges received from those areas help retire the bonded indebtedness of the District and thus allow earlier construction of a central treatment plant at the ultimate site. With this in mind, it was evaluated that the first stage treatment plant should be constructed of such a size that it could reasonably serve the area until such time as the population in the general drainage pattern reached such a density and extent that the main treatment plant at the ultimate site could be financed. In addition to this factor, conservative bond buyers must also be satisfied that the initial treatment plant constructed would adequately serve the District's population during the life of the bond issue whether or not anticipated annexations and increased revenues should be realized.

Population Studies

With this in mind, population studies were made and analyzed from the standpoint of future development of the overall drainage area as well as for the immediate development of the existing district. All population data were reduced to families per acre for the convenience of the financial consultants in determining finability of construction in the area.

Studies were based on actual house counts in various areas, together with data published in "History of King County Population Growth by Study Area", by the King County Planning Commission. The study area used was the Highline study area which covered in part

the drainage area under discussion. The total Highline area as studied by the King County Planning Commission was approximately 25,800 acres. This study, with projections to 1970, is summarized in Table 1.

The data in Table 1 give a possible potential for the future of the overall drainage area for the Des Moines Sewer District. However, information relevant to the existing district and the immediate area surrounding it was necessary for an accurate projection for the existing district. Therefore, house counts were made by Hill & Ingman in the existing 311 acre district in the years 1946, 1948 and 1956. Using the average number of persons per family as 3.52, Table 2 was compiled.

It could be seen from the projected population curves that the 311-acre Des Moines Sewer District would have a population density of

approximately 1.75 families per acre in twenty years (1978). At 3.5 people per house this equals 1900 people. To this was added the anticipated population from an apartment development now completed, called Wesley Gardens and consisting of a population of approximately 300 senior citizens. This gave a total population of 2,200 in the 311 acres at the end of twenty years.

The next factor studied was the population density in a reasonable portion of the drainage pattern in the vicinity of the District to establish when that density would be adequate to finance at least the first-stage capacity of a main treatment plant at the ultimate site. The financial consultants advised that when the District and surrounding area of considerable size reached an average population density of approximately 1.2 to 1.3 families per acre of

Table 1—King County Planning Commission
Highline Area Study

Year	Population	Families	Families per
			Acre
1920	8,550	2,530	0.098
1930	11,500	3,270	0.127
1940	21,300	6,050	0.234
1950	52,900	15,050	0.583
1955	71,824	20,400	0.791
1960	86,224	24,500	0.950
1965	95,480	29,150	1.050
1970	104,444	29,600	1.150

Table 2—Existing Des Moines Sewer District

Year	House Count	Population	Families per
			Acre
1946	270	950	0.87
1948	350	1,230	1.12
1956	400	1,410	1.29

reasonable valuation, they could be assumed capable of financing additional sewers and construction of the first stage treatment facilities at the ultimate site.

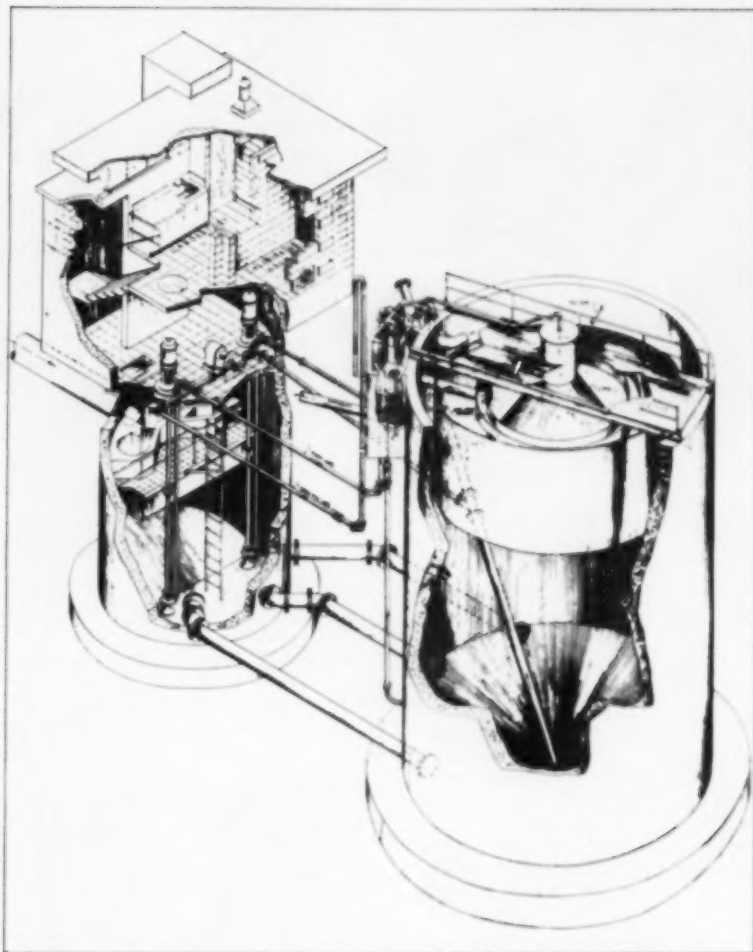
In 1953 and 1957 house counts were made in an area comprising approximately 2,285 acres, which included the existing district. In this period the number of houses in the area increased from 1,036 to 2,138; population rose from 3,640 to 7,530 based on 3.52 persons per house; and population density increased from 0.496 to 0.935 families per acre.

The comparison of the history curve and the projection curve of the Highline Area by the King County Planning Commission with the curves of actual house counts would indicate that the King County Planning Commission study was on the conservative side for this area. The curve of the existing Des Moines Sewer District population indicated a rapid growth during the post-war years of 1946 to 1948 and then a decline in growth which could at least in part be attributed to the inability of the area to meet the requirements of the King County Health Department for septic tank construction. However, the area immediately adjacent to the existing district showed a sharp population increase in the years 1953 to 1957, which would indicate that there is a definite trend of growth for the general area provided septic tank approval is available. This leads to the conclusion that with sewers available the area population would grow at a rate considerably above the projected rate of the King County Planning Commission. Since 1958 (when sewers were constructed), the actual growth rate has proved the soundness of this conclusion.

Assuming saturated population for the District and future annexations as 12 persons per acre and an average of 3.5 persons per house, the following was obtained from the projection curve for 2,285 acres.

Year	Families per Acre	Percent of Saturation
1970	1.62	47.3
1980	1.88	54.8
1990	2.07	60.4
2000	2.20	64.2
Saturation	3.43	100

From the plot of the prediction curves, it can be seen that the 2,285 acres immediate to the existing District would appear to have sufficient population to warrant sewer construction by approximately 1962.



● TREATMENT plant provides clarification in upper compartment and sludge digestion below. It is designed for easy conversion to pumping station at some later time.

This being prior to 1978, the 2,200 population mentioned earlier was established as the design criteria for the first stage treatment plant capacity.

Sewer and Plant Design

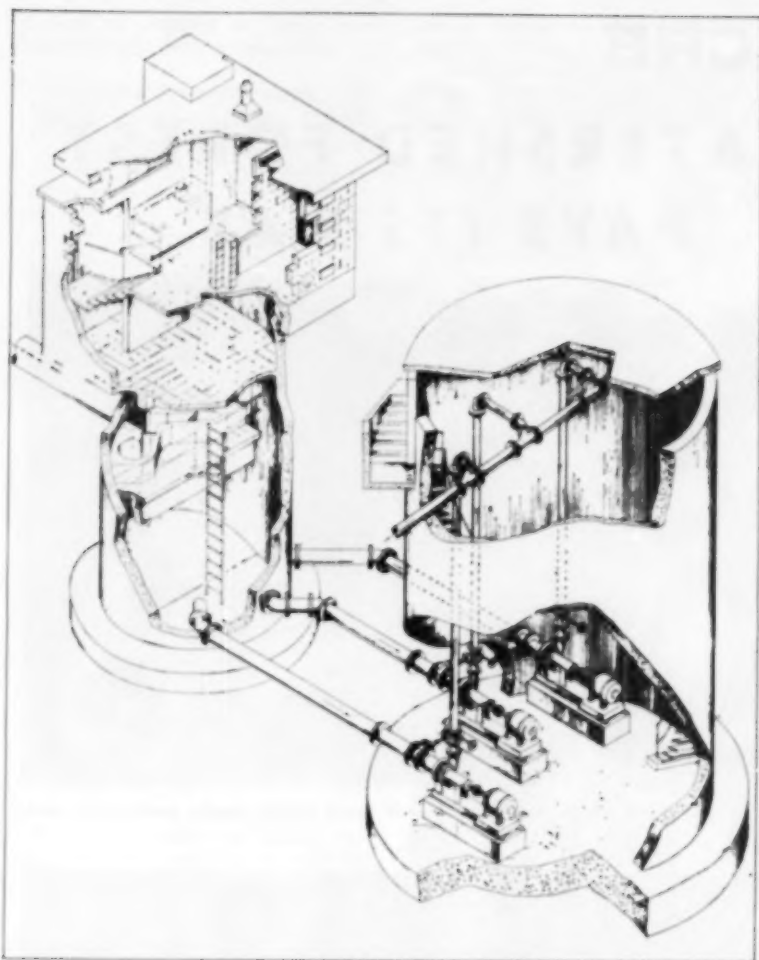
The trunk sewer initially constructed to serve the 820-acre area was designed with sufficient capacity to serve that area in its ultimate development. Similarly, trunk sewers in the other portions of the existing district were designed to serve the ultimate development within that portion of the drainage pattern which cannot drain by gravity to the ultimate treatment plant site.

The next factor was the exact type of treatment plant installation to be constructed initially at the low point of the 820 acres to serve 311 acres thereof. Coordination with the regulatory agencies and evaluation of the receiving waters (Puget Sound) indicated that primary treatment with chlorination of the effluent and

discharge to deep water would be adequate. Of course, the units also had to be easily convertible to a pump station to pump the sewage from the 820-acre area to the ultimate plant site.

A conventional clarifier with separate digestion facilities would not lend themselves well and economically to this planning. However, an apparently ideal solution was found through use of a Spiragester as manufactured by Lakeside Engineering Corporation.* (This conversion plan will be discussed further in the next paragraphs.) With this plan in mind, cost estimates were completed and the legal comprehensive plan prepared. This was adopted by the Sewer District Commissioners, and approved by the Pollution Control Commission in their letter of September 26th, 1956. In November 1956, the plan and fi-

*A similar unit is available from the Yeomans Brothers Company under the trade name of Spirahoff.



● AFTER conversion to use as a main pumping station. Pipes with blind flanges, shown on opposite page, will be connected to pumps placed in present digester area.

nancing program was approved by the voters.

In the spiragester, two compartments are created. In general, the upper compartment is a clarifier or sedimentation unit which accomplishes the usual primary treatment. The solids from the upper compartment settle through a baffle system into the lower or digester compartment. There is essentially no mechanical equipment projecting into the facility.

A small pump station was required at the initial treatment plant to raise the sewage to a sufficiently high elevation to accomplish two purposes: (1) Enable construction of the sewage treatment facilities with reasonable excavation requirements, and (2) cause the sewage to flow through the outfall from the treatment plant into Puget Sound even under extreme high tide conditions. To handle the flow from the 2,200 design population, a pair of relatively small multiple-speed, ver-

tical, wet-pit, non-clog-type Chicago pumps were installed in a relatively small separate pump station structure. However, that structure would not accommodate the necessary pumps to handle the entire flow from the ultimate density which will one day be realized from the 820 acres. To facilitate pumping of that flow, the economical solution was evolved wherein the small structure will ultimately be merely a wet pit forming a part of the pumping system. The treatment plant proper will be converted to become a dry pit for horizontal-centrifugal type pumps feeding from the small wet well. To facilitate this, three suction pipes were installed between the smaller and larger structures and equipped with blind flanges on each end. These pipes will ultimately be connected to horizontal-centrifugal type pumps in what is now the digester portion of the spiragester. Conversion of the spiragester to a dry-pit room will be

extremely simple, involving essentially only the lifting of the cone and weirs from the upper portion of the unit, removal of a single sludge pipe and installation of a roof and access stairway. Thus, not only does the spiragester accomplish the primary treatment required now but will also allow the later modification to a pump station with a minimum of waste and the least possible cost.

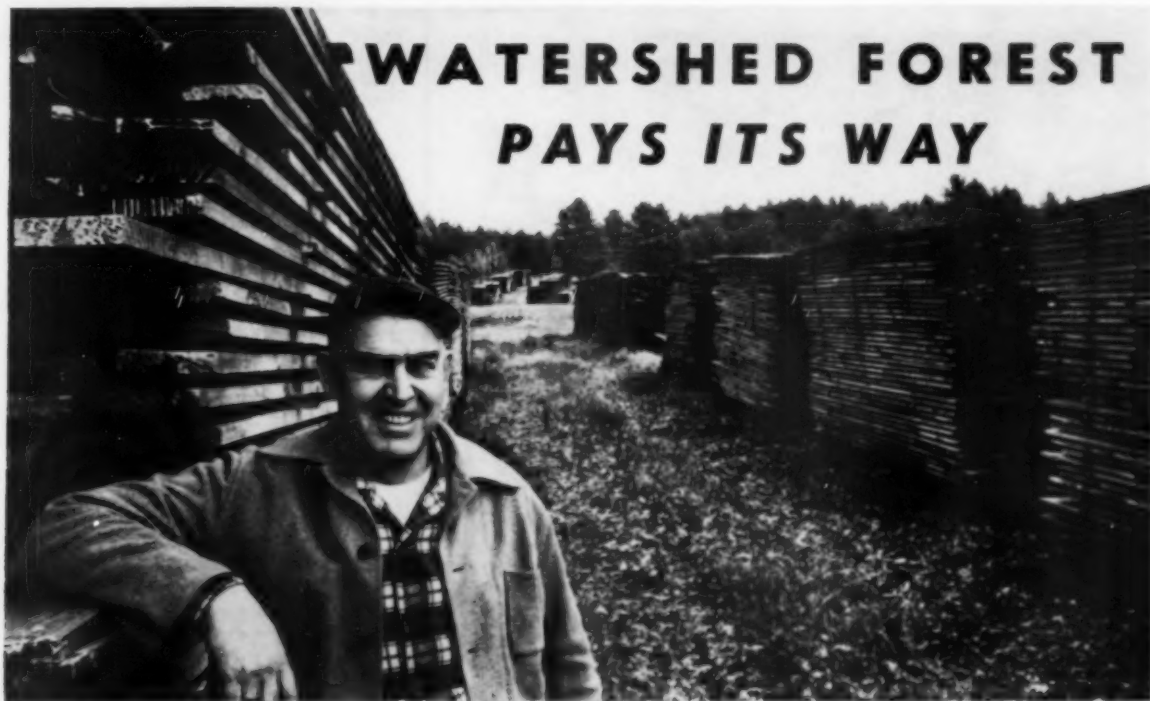
In the design selected for the initial treatment plant, the spiragester has a 26-ft. inside diameter and an overall depth of 32 ft. The base is spread beyond the walls so that the load of the backfill material upon it will assist in preventing flotation of the unit. The pump station beside the spiragester has an inside diameter of 12 ft. and an overall depth from the first floor to the bottom of the wet well of 27 ft. 9 ins. In addition to the sewage pumps this structure houses a single plunger type sludge pump, a comminutor, a Wallace & Tiernan chlorinator and a small laboratory. Flow measurement to the plant is through a Parshall flume with measurement recorded on Foxboro strip chart equipment. The comminutor, a Chicago Pump Co. unit, is driven through an extended shaft from a motor mounted in the motor room above to prevent flood damage.

Emergency power was considered but it was felt, and concurred in by the regulatory agencies, that since the area is served by multiple main feeder lines, power outages would be of short duration and that little, if any, damage would result in the discharge of chlorinated bypassed sewage for the few minutes involved in the possible power outages. Therefore, to handle this matter, a rather unique, hydraulically actuated valve was provided which diverts the flow to the by-pass during power outages. Using available water pressure and a remote hydraulic cylinder (mounted considerably above the maximum possible elevation of sewage), and a solenoid controlled 4-way, 4-port, 90° turn water valve, the main gate to the treatment plant will automatically close upon a power failure and will automatically open on restoration of power, thus appropriately diverting the sewage.

Actual contract costs involved in construction of the entire treatment plant and initial pump station exclusive of outfall were \$105,000. The G. R. Leischner Construction Company of Seattle was the prime contractor. The project engineer for Hill & Ingman was Donald M. Williams, Registered Professional Engineer.

AN 8000-ACRE

WATERSHED FOREST PAYS ITS WAY



● LUMBER stockpiled near the Manchester sawmill, with the author in foreground. Most of the lumber produced is sold.

A. J. CHRISTIE,

Forester,

Manchester Water Works,

Manchester, New Hampshire

BY FINDING commercial outlets for all the products of our forest management program we are able to finance the constant improvement of our watershed. This means not only water conservation, but also the development of quality timber for which there is a growing demand.

Our watershed supplies 4,186 billion gallons of water annually to the people in the Manchester area, including the towns of Bedford, Auburn, Hooksett, Goffstown, and the Grenier Air Force Base. The Manchester Water Works owns 8,000 acres, or about one-third of the total watershed. Water drains from six ponds into Massabesic Lake, where both low pressure and high pressure pumping stations are located.

The aim of our forestry program is to develop a high grade stand of timber, and to manage the forest so as to reduce runoff and erosion and produce a steadier yield of better water. For instance, by growing



● AFTER cutting and trimming, the pine bolts from Manchester's watershed forest are loaded onto a "scoot" for hauling out of the woods and transfer to a truck. Lumber not used in system operations is sold to finance further watershed development.

a protection strip of white pine 75 ft. to 100 ft. wide around the shore of each storage reservoir, we prevent hardwood leaves and litter from getting into the water and causing discoloration. Similarly, by replacing hardwood with pine wher-

ever possible, clearer water results since rain quickly seeps downward through pine needles and does not get stained by hardwood leaves. One way in which we conserve water is by selective thinning; this enables snow and rain to reach the ground

instead of clinging to leaves and branches and then evaporating.

Rapid Forest Growth

We have eight men doing forestry work the year around, primarily thinning, pruning, releasing, replanting, and controlling diseases and insects. To date we have planted 1,839,000 seedlings of various species. Most of the thinning and logging is done with outside contract crews. Our forest is growing at the rate of nearly half a million board feet per year. The costs of maintaining this growth rate, and at the same time improving the forest from the water purification and conservation viewpoint, are considerable. For example, our pruning cost is 1¢ to 1½¢ per linear foot of the tree. We prune only the first 16 ft. of the trunk, which contains about one-half of the volume of a mature tree, such as a white pine. Atkins banana pruning saws enable us to do this from ground level. Beyond 16 ft., pruning costs become prohibitive.

Releasing, which means removing the young, poor growth and the undesirable species, allowing the better trees to develop, costs \$7 to \$8 per acre. We use McCulloch chain saws and a Wright reciprocating saw for all our heavy cutting operations.

In our program, all these and other costs are completely paid for by the sale or utilization of our forest by-products.

We Own A Sawmill

We have our own sawmill where we have processed 4,503,335 board feet of lumber to date. Of this lumber, 390,279 board feet have been used in construction work and other projects by our department at considerable savings. We built a fire lookout tower with materials from our property. Our lumber has been used for guard rails in several of our public parking areas. Thousands of feet of our wood products have been used as bridge timbers and for truck bodies, for form work and for repairing our own buildings. Posts, poles, and lumber have gone into work camps, office equipment, sheathing and many other uses.

We used to sell the by-product slabs, edgings and clippings from this sawmill operation at 50¢ a cord for firewood; and sometimes we didn't get that much. In our search for better utilization of all our waste materials, we recently installed a Fitchburg chipper in our sawmill. Slabs and edgings as wide as 14½ ins. are now dropped into a chute leading to the chipper. The serrated blades cut this waste into fine chips

which are blown onto a stock pile outside. These chips are now sold to dairymen and poultrymen as they make an excellent litter. Another mill waste, sawdust, is sold in the same way.

We now get over five times more per cord for such chips than we used to get for slabs. Slabs and edgings are easier to handle this new way, an important factor when considering that there are as much as 2 cords for each 1,000 feet of logs.

All Wood Utilized

Fortunately there are markets within 25 to 30 miles for our other forest by-products. We sell posts and poles to the New England Pole and Wood Company and to the Kop-

pers Company. Cooperage materials are sold to Spalding & Frost for barrels, and to the White Mountain Freezer Company for making home-use ice cream freezers. Soft and hardwood pulp is sold to two paper companies, Brown & Co. and Champion International.

Every scrap of wood is utilized—even the slash, which is left on the ground to rot and to increase the humus content of the soil. The money from the sale of our forest products is constantly plowed back. This makes it possible for us to develop continuously our 8,000-acre watershed forest—at absolutely no out-of-pocket cost; and in future years we hope even to make a profit.



● **FINAL STEP** in utilization: Waste wood from the sawmill is fed into a Fitchburg chipper which converts it into chippings sold as litter to many local farmers.



● **FORESIGHT** in designing and constructing Runway 10-28 a decade ago has permitted airport to handle today's heavy jets.

SOUND ENGINEERING and PLANNING PAY OFF FOR AIRPORT

JOSEPH E. LAIRD

Executive Director,
Maryland Asphalt Association

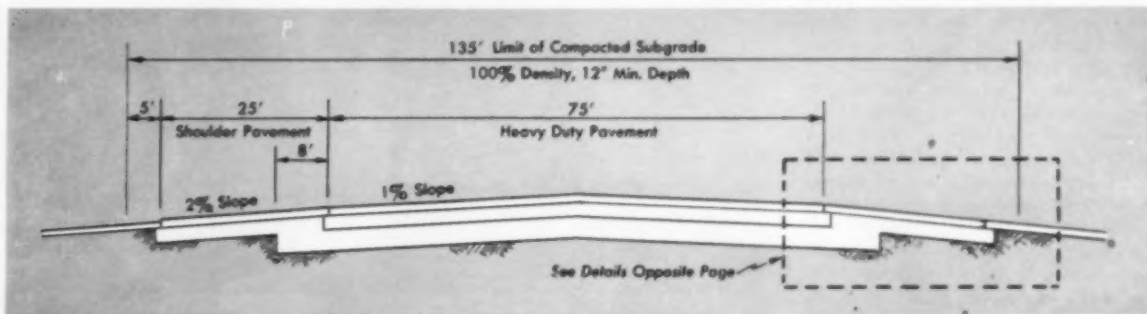
TEN YEARS after Baltimore's Friendship Airport runways, taxiways, and aprons were paved they were able to accommodate, without further strengthening, new commercial jet planes with gross loads of 296,000 lbs. and tire pressures of 120 psi. This service stands as a tribute to the foresight and abilities of the engineers who planned, designed, and constructed these excellent facilities, beginning some fourteen years ago. Two consulting engineering firms, Whitman Requardt & Assoc. and J. E. Greiner Co., were responsible for the engineering work.

New ideas, concepts, and techniques, that attracted worldwide attention during the late 1940's, were

incorporated in the original construction of Friendship Airport. The engineers' prediction as to the economy of operation is being fulfilled as annual pavement maintenance costs have been negligible to date, and recent inspections indicate only inexpensive routine maintenance for the future. This article will deal essentially with the asphalt pavements, including a brief review of the original engineering, its performance over the years, and the present and future construction required for the "jet age."

Friendship Airport, situated on a 3,200-acre plateau which is remarkably free from fog and smoke, is nine miles south of Baltimore's business center. Excellent highway facilities enable users to traverse that distance in 15 minutes. Friendship is only 29 miles (of limited-access dual highway) and forty minutes from the center of Wash-

ington, D. C., and considerably less to its Maryland suburbs. Its location between Baltimore, with its excellent port facilities, industrial complexes, and suburban areas and Washington, D. C., with its government offices and expanding suburbs, makes it one of the most accessible major airports in the United States serving such a heavily populated area. The Pennsylvania Railroad's main line adjoins the western property boundary, and the Baltimore and Ohio Railroad is in the immediate vicinity. The Airport has three runways of 6,000, 6,440 and 9,450 ft. length. The 9,450 ft. long runway, 200 ft. wide, equipped with an electronic Instrument Landing System and high intensity approach lights, is handling the commercial jets at this time. Sufficient property was acquired originally to lengthen the three runways and construct additional ones. Zoning regulations



● **CURRENT** improvements include construction of taxiways and added shoulders. Typical taxiway section is shown above.

were obtained that assure favorable approach glide angles and turning zones for present facilities and future expansion.

Original Construction (1947-1949)

Most of the soils on the Friendship site are sands and sandy gravels classified as A-2 and A-3 materials. Present also are deposits of white silty clay of very low bearing capabilities. During the heavy earthwork phase of original construction, soil densities were obtained that ranged from 95 percent to 107 percent with an average of 99 percent (modified A.A.S.H.O. Method). Compaction required four passes with a heavy sheepsfoot roller for each 8-in. lift. Under a separate contract, subgrades in cuts and fills were given 4 coverages with a 150-ton supercompactor. Usually 3 passes with the supercompactor would detect unstable material. This material, mostly lenses of the white silty clay, was then removed to a depth of 5 ft. 3 in. below finished grade.

The pavement was designed for 100,000-lb. wheel loads and consisted of 10 in. of bituminous concrete on 5 in. of granular selected subbase material. The granular subbase was placed and disked into the subgrade and then given 8 passes with the heavy sheepsfoot and 8 coverages with the supercompactor. Between passes and coverages, the surface was dragged lightly to erase tracks. After supercompacting, the

subbase was bladed, sprinkled, and rolled with a 10-wheel, 11-ton pneumatic roller.

The 10-in. asphaltic concrete was placed in four courses. On the subbase was placed a 3½-in. course of bituminous concrete which used a bank-run sand gravel aggregate obtained from the site. Next came another 3½-in. course of the same type bituminous concrete. The 3-in. bituminous concrete surface course was placed in two layers, and utilized a crushed stone aggregate. A seal coat was then placed over the runways and taxiways. This pavement cost less than \$3.00 psy, including the heavy compaction of the subgrade. The total area of the apron, runway, and taxiway amounted to 746,000 sq. yd. Table 1 shows pavement specification data.

Performance

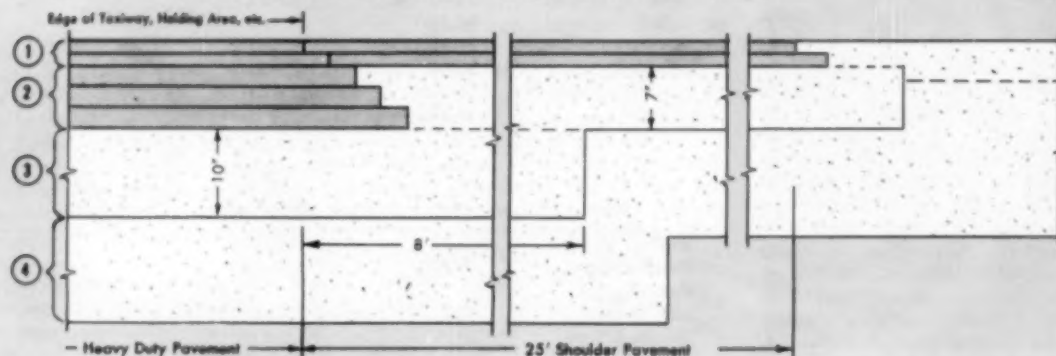
Colonel John O. Colonna is Director of Aviation for the City, and is responsible for the operation of Friendship Airport. Mr. Bruce H. Chilcote is Principal Engineer and is responsible for the engineering required to operate and improve the field. Mr. E. R. Rosier has been Maintenance Supervisor since the field was opened. The Benjamin E. Beavin Co., Consulting Engineers of Baltimore, have been retained since 1957 to make annual (or as required) inspections of the airfield facilities (excluding Terminal Building), and to prepare plans and specifications for new requirements. The 1959 pavement inspection (10

years after completion) reported the pavement to be in excellent condition. No settlement has occurred that has affected the original smooth riding qualities of the pavements, nor was evidence of distress in the pavement detected. Items of a routine maintenance nature were noted in the report, and will be included in this article. A 1957 inspection had recommended seal coating of that portion of the apron pavement that was not seal coated at the time of construction. This work was done during 1959 with a slurry seal being employed.

Minute cracks have developed to a small degree in the paved areas, mostly along the paving machine joints. These cracks averaging 1/16-in. width x ¾-in. depth, are considered to be of minor significance. When large enough, they are filled with a crack sealer known as Maryland "K" which is 85-100 penetration asphalt with 15 to 25 percent mineral flour. The runway and taxiway having the most traffic show very few such cracks. The entire pavement area is gone over each year by the maintenance crew and cracks are sealed. This operation entailed approximately 50 man-days during 1959.

In two locations at the junction of taxiways, several cracks together with raveling occurred across the intersection. These were corrected by removing a section of the surface 1-ft. wide by 40-ft. long by 3-in. deep and replacing in kind. The blast and heat effect of the jet air-

- 1—3-in. BITUMINOUS SURFACE COURSE placed in two 1½-in. layers. Bituminous seal coat on heavy duty pavement only.
- 2—7-in. BITUMINOUS BASE COURSE, hot plant mix, placed in three courses.
- 3—SUB-BASE COURSE, select material compacted to 100% density, placed in two equal layers. Prime coat on top.
- 4—SUBGRADE compacted to 100% density, 12" minimum depth.



● DETAILS of pavement section used for taxiway and the new holding areas and shoulders at the Baltimore airport.



● HEAVY compaction equipment was used to obtain 92 percent density on the bituminous concrete base course and 98 percent density on the bituminous surface course.

craft now using the airport does no apparent damage to the pavement. Several years ago some surface erosion occurred in a few small areas at the ends of the runways which was attributed directly to the blast effect of Navy carrier-based jet aircraft then using the airport. The Airport Maintenance Crew has effected repairs (totaling no more than 50 sq. ft. for the entire pavement) by tack coating and filling in with a hot sand asphalt mix. Gate positions and other service areas which are exposed to spillage of gasoline, jet fuel, hydraulic fluid, and lubricants from parked aircraft require the most attention. Thin bituminous seal coats that are resistant to these solvents are applied about every other year to the bituminous concrete surface in these particular areas. It is estimated that it has cost less than nine cents per square yard to maintain the pavement area over the entire ten-year period. This includes all crack sealing, gate position service, sealing a portion of the apron not originally done, and the miscellaneous work.

The trend in aircraft appears to be toward increased gross weight. Once aircraft loads exceed the original design loads, the pavements can be strengthened rapidly and economically by placing a minimum thickness of bituminous concrete on the existing structure. These new courses of bituminous concrete become an integral part of the structure, and increase greatly the load bearing capacity of the pavement. This stage construction method was

anticipated in the original design of the pavement.

Current Improvements and Construction

Friendship is currently embarked on a construction program to improve even further its jet plane and other accommodations. The construction undertaken during 1959 is now in service, while engineering work is proceeding on facilities required in the near future. Contracts in excess of a half-million dollars

were under construction during this past year. The majority of expenditures went into Contract No. 21, which included the following heavy duty bituminous concrete pavement and lighter duty bituminous shoulders:

1. Extend taxiway to West, 2300 ft. by 75 ft.
2. Construct two holding areas approximately 200' x 500'.
3. Widen a portion of the apron in front of the Terminal Building.
4. Construct 25-ft. wide shoulders on both sides of three taxiways, and at both ends of East-West runway for a total of approximately 20,000 lineal feet.

Plans, specifications, and construction supervision for Contract No. 21 were handled by the Benjamin E. Beavin Co., and included the above work together with all grading, drainage, erosion control and lighting. The E. Stewart Mitchell Co. of Baltimore was the general contractor. The Consultant's knowledge of the soils, aggregates available on the site, necessary construction controls, compaction requirements, and pavement performance obtained during initial construction proved to be invaluable to the owners. Specifications were written to utilize the soils to the best advantage, and to use the sandy gravel deposits as subbase material. The 8-in. lifts in embankments were required to be compacted to 95 percent of maximum density as determined by the A.A.S.H.O. Method T180-57, Method

TABLE 1—ORIGINAL CONTRACT PAVEMENT SPECIFICATIONS

Sieve Size	Percent Passing		
	Bituminous Concrete		
	Base - 7"	Binder - 1 1/2"	Surface - 1 1/2"
1"	-	100	100
3/4"	-	75-100	85-100
1/2"	100	64-88	72-92
3/8"	90-100	-	-
#4	75-100	38-64	46-70
#10	56-90	25-50	32-55
#40	24-56	12-28	16-33
#80	8-35	7-18	10-23
#200	5-10	2-10	4-10
Item	Specification		
Asphalt Cement	5.5-7.5%	4-6.5%	5.5-7%
Penetration	85-100	100-120	100-120
Pen. (Apron)	-	-	85-100
Lab. Density	92%	96%	96%
Marshall Stab.	1000	1400	1400
Straight Edge	3/8" in 16'	1/8" in 10'	1/8" in 10'
Thick. Tolerance	-	-	1/4"

D. Although not specified, the contractor obtained his densities with a 50-ton compactor. Subgrades in cuts and fills were required to have a maximum density of 100 percent for 12 in. below subgrade. Four coverages of the 100 ton supercompactor were required on all subgrades. If unstable material was discovered by compactive effort or by boring, it was removed to a depth of at least 4 ft. below subgrade. Material removed was replaced with suitable material in 6-in. layers and compacted with at least 4 coverages of the supercompactor. After rolling, subgrades were reshaped to grade and section, and rolled with a lighter rubber-tired roller.

The heavy-duty pavement consists of 10 in. of bituminous concrete on 10 in. of selected subbase material. Thus, the 20-in. pavement placed in 1959, had an additional 5-in. course of select gravel material compared with the original pavement section. The 3-in. bituminous concrete surface employed crushed stone aggregate and was placed in two courses. The 7-in. bituminous concrete base course used a pit-run gravel and stone screenings as the aggregate, and was placed in three courses. The 10-in. selected subbase material was placed in two layers, each of which was required to be compacted to 100 percent of maximum density at optimum moisture content and proof-rolled with two coverages of the 100 ton supercompactor. The selected subbase material, obtained from the site, was required to have a liquid limit not exceeding 25, and a plasticity index of not more than 6 for material passing the No. 40 sieve. Under Contract No. 21, the heavy duty asphalt pavement cost \$3.50 per square yard, which is quite economical for a pavement with the known capabilities of the one constructed. Table 2 shows pavement material data.

Future Plans

Plans are currently being made to construct certain additional facilities this year. Other improvements contemplated for several years in the future are being processed at the present time. The determining factor in scheduling such construction rests with the increase in traffic. The increase in regularly scheduled flights, both jets and other-type planes experienced during 1959, was considerable, and indications are that many additional flights will be scheduled this year. With this potential business in sight, it appears that construction activity will be mandatory to maintain Friendship's

TABLE 2—1959 CONTRACT PAVEMENT SPECIFICATIONS

Sieve Size	Selected Subbase Material	Percent Passing	
		Bituminous Concrete	
		Base - 7"	Surface - 3"
2½"	100	-	-
1½"	-	100	-
1"	-	86-100	-
¾"	70-100	68-92	100
½"	-	55-84	82-100
¾"	32-70	46-76	68-90
#4	-	32-64	50-79
#10	-	20-50	36-67
#40	5-35	8-30	17-44
#80	-	4-19	9-29
#200	0-10	3-8	3-8

Item	Specification		
Asphalt Cement	-	4-6%	5-7.5%
Asphalt Penetration	-	100-120	100-120
Lab. Density	100%	92%	98%
Marshall Stab.	-	1000	1500
Straight Edge	¾" in 10'	¾" in 16'	¾" in 10'
Thick. Tolerance	-	-	¼"

"first" in facilities. The summary below lists, in the order in which they will be undertaken, the improvements planned for the immediate future.

1. Construct light-duty bituminous blast pads at both end of East-West runway.

2. Provide additional gate positions in front of the Terminal Building.

3. Extend Northwest - Southeast runway approximately 2,000' in a north westerly direction, and extend taxiway to reach the new terminus.

4. Extend same runway approximately 1,000' in south easterly direction, and extend taxiway to accommodate it. (The completion of this project will give Friendship another runway in excess of 9,400 ft. long that can handle large jet planes.)

5. Construct a 10,200 ft. runway parallel to No. 3 above and east of control tower, with companion taxiways and holding blocks.

The Master Plan for Friendship Airport, conceived more than ten years ago, now permits the Airport to grow and to expand its services and facilities in an orderly and economical manner. Naturally, some revisions have been made, but the site location, property required, position and future extension of runways, and zoning regulations were foreseen and incorporated in the original project.

Sound engineering, including design, specifications, and construction controls are helping Friendship meet its expansion requirements in two ways. First, the pavement installed over ten years ago requires very little attention and expense to maintain, hence monies for capital improvement do not have to be diverted for maintenance. Second, the economical cost of the heavy-duty bituminous concrete pavement with its proven performance record means that the Airport is getting the most square yards of paving possible from its available construction funds.



● UNSUITABLE materials detected during compaction or by boring were removed to 4 feet below the subgrade.

PAVEMENT EDGE MAINTENANCE

B. W. DAVIS
State Maintenance Engineer
North Carolina State Highway
Commission

A COMBINATION of corrective and preventive maintenance by strengthening the edge of a bituminous surface treated pavement with a ribbon-type reinforcement of sand asphalt is shown by the accompanying pictures of a job on a secondary road in Sampson County, North Carolina. The patch mixer and strike-off spreader were pulled in tandem by a 2-ton dump truck. Similar edge-reinforcing jobs have been done in other North Carolina counties with materials ranging from a sand seal to bituminous mix prepared in a hot-mix asphalt plant. The pre-mixed material is recommended for this type work when it is available. The use of a pre-mixed material from a central mixing plant will greatly increase daily production in linear feet of ribbon-type reinforcement and reduce the cost per square yard.

The strike-off spreader used in Sampson County is home-made from 8-in. drag blades. It is non-rental equipment but is shown in

Daily and Unit Cost Record

MATERIAL	Quantity	Unit Cost	Extension
Pit Sand	35 tons	\$0.10	\$ 3.50
Asphalt (RC-2)	760 gal.	0.10	76.00
Total			\$79.50
EQUIPMENT:	Number	Rental	Extension
Model 700 Littleford Mixer	1	\$318 per mo.	\$17.67
600-gal. utility distributor	1	144 " "	8.00
3.5-ton roller	1	210 " "	11.67
2-ton truck	2	195 " "	21.66
Strike-off spreader	1	18 " "	1.00
Total			\$60.00
LABOR:	Number	Rate	Extension
Maintenance Foreman II	1	\$364 per mo.	\$ 20.22
Truck Driver	2	268 " "	29.78
Machine Operator II	4	319 " "	70.89
Total			\$120.89
GRAND TOTAL PER DAY			\$260.39
UNIT COST PER SQUARE YARD			\$0.098

Note: Daily production of approximately 2.5 miles on one edge, 22-in. (1,803-ft.) wide, equalled 2644.4 sq. yds. Daily rates figured at 1/18 of monthly rates. Asphalt includes 525 gal. in mix and 235 gal. (0.1 gal. psy.) used as tack coat.

the cost data at a nominal cost of \$1.00 per day. Several districts of the North Carolina State Highway Commission have strike-off spreaders similar to the unit shown in the pictures.

The ribbon-type edge reinforcement is recommended for use where

pavement edges show signs of weakness or possible future failure. This type of program can also be used to correct a difference of elevation between an old pavement and a widened section where the widened section is depressed by settlement or from other cause.



● RIBBON-type edge reinforcement being placed along the shoulder of old highway using Littleford trailer-mixer unit.



● OPERATIONS of placing and rolling ribbon-type edge reinforcement are shown here, with mixer, strike-off and roller.

DESIGN and CONSTRUCTION of Small Dams

CARL A. ELSEA

Hydraulic Engineer,
Soil Conservation Service,
Sioux City, Iowa

SMALL DAMS have been in use in the Midwestern states since the early settlers arrived. Probably their first use was to store water for power to turn the old mill wheels. These mill ponds were also used to supply water for livestock and for domestic use. In addition, they provided excellent recreation areas.

As the country became more thickly settled, individual farmers and ranchers began using small dams in intermittent streams to store spring runoff for stock water and irrigation. When farming became more intensified and gully erosion became a problem, small dams were used effectively to combat this type of erosion.

During this early period of agricultural development of the Midwest, competent technical assistance was expensive and most often not available. This resulted in haphazard design and construction of small dams, many of which failed with the first storm. However, many of them were good for several years and served their builders well.

When the Soil Conservation Service came into being in the early 1930's, it provided farmers and ranchers much needed technical assistance in the design and construction of small dams. As the soil and water conservation program developed, better design criteria and construction methods were found through research and development. Now this service is available to all areas of the United States and its territories that are organized into Soil Conservation Districts.

Land owners singly or in groups may request assistance from the Soil Conservation Service through their own Soil Conservation District. When a request for a dam or a series of dams is received, a preliminary

investigation is made to determine whether good conservation practices are in operation or planned in the watershed above the proposed dam. Good practices include approved crop rotations, terracing, contour farming, good pasture and timber land management.

The design and construction of small dams in the Midwest vary somewhat with rainfall, soil type and topography. Typical examples of the methods used in the Little Sioux River basin in Northwest Iowa will be considered.

The construction program was started in the Little Sioux River Basin in 1946. The Soil Conservation Service has assisted with the design and construction of 190 detention structures, 120 drop spillways, and 54 chutes.

This program was authorized by the Flood Control Act of 1944, Public Law No. 534, 78th Congress.

Preliminary Investigation

In this area the preliminary survey usually consists of obtaining 1) The size of the watershed in square miles; 2) the soil type and slope of the various parts; 3) the land use and conservation practices; 4) a profile of the main waterway flow line and banks; 5) a topographic map with 5-foot contour intervals of the areas where dams may be located (the water storage area is included on this); and 6) one or two cross-sections at the possible dam sites.

With this information, the design engineer makes an estimate of the cost of the project. This cost is compared with benefits that may be expected from the finished project. Those benefits usually include flood prevention; soil erosion reduction; reduction of gully erosion damage to agricultural lands, farm buildings, farm crossings, and road bridges; reduction of the hazard of livestock loss; and reduction of sediment damage to farm crops, drainage ditches and roads. Monetary evaluations are made of these benefits to

determine the economic justification of the installations.

Detailed Survey

A more detailed survey is necessary before final design is possible. This includes establishing a base line perpendicular to the center line of the proposed fill. It is often necessary to establish an offset line parallel to the base line. Cross-sections are taken perpendicular to the base line so that the volume of fill can be computed by the end area method. A few cross-sections are taken in the storage and borrow areas. The base line and cross-sections are plotted on the original topographic map. A detailed profile of the flow line and bank are developed from the detailed cross-sections.

A foundation investigation is made at each dam site. In the deep loess area this usually consists of soil borings in the area that will support the dam and in the borrow area. The borings may be from 5 to 45 feet deep. Samples are saved at approximately 5-foot intervals in each hole. A mechanical analysis is made and natural moisture is determined for each sample. The liquid limit, plastic index, and moisture density relationship are determined for material that may be used in the fill.

Flood Routing

In order to design a detention dam it is necessary to know the following: 1) The height of the dam; 2) the elevation of the inlet and outlet and size of the conduit or principal spillway through the dam; 3) the elevation of the emergency spillway; 4) the area and volume of the temporary storage; and 5) the required sediment storage.

The first four of these items are determined in part by flood routing a typical 6-hour storm for the selected frequency. The frequencies used in this area are 25-year, 50-year, and 100-year.

The first step in flood routing a storm is to determine the inflow



● BEFORE: Farm buildings shown in the background are being endangered by erosion. The gully shown is 30 ft. deep.



● AFTER: A small earth dam with a chute spillway has been constructed at site to protect farm buildings and prevent erosion.

hydrograph which is a curve with inflow in cfs plotted against time. This inflow hydrograph is obtained by considering the following: 1) drainage area; 2) time of concentration (this is the time required for water to flow from the most remote part of the watershed to the storage area); 3) total rainfall in the six-hour period for a selected frequency; 4) runoff conditions, which depends on vegetative cover and farming practices; 5) time to peak in hours, which is considered to be 0.7 times the time of concentration. In this area for the 100-year frequency storm, the 6-hr. rainfall (item 3 above) is 4.8 ins.; for 50 years, 4.4 ins.; and for 25, 3.9 ins. The above information is applied to a dimensionless hydrograph developed by the Soil Conservation Service. The result is the inflow hydrograph for a particular watershed for the selected frequency.

This inflow hydrograph is plotted with cfs against time. The available storage curve is plotted in acre-feet against stage in feet above the inlet of the principal spillway. The size of the principal spillway is assumed, and its discharge capacity in cfs is plotted against stage above the inlet. From these curves it is possible to plot the outflow hydrograph in cfs against time, and the actual storage in the reservoir is plotted in acre-feet against time, as shown in the example on the opposite page.

Maximum storage occurs at the time when the outflow is equal to the inflow. This maximum storage is projected to the available storage curve and thus the maximum stage for the selected storm is obtained.

The crest of the emergency spillway is usually located at the elevation of the maximum stage for the design storm.

With two or more detention structures in series on the same stream, the inflow hydrograph of the second is the sum of the inflow hydrograph from the area between the structures and the outflow hydrograph of the above structure. The inflow hydrograph for each of the structures below is obtained in the same manner.

Detention dams in the Little Sioux River Basin are designed for a life of at least 50 years. To be effective as detention structures there must be storage space provided for a 50-year yield of silt from the watershed above the dam. The silt yield depends on the size of the watershed; the slope of the various parts of the watershed; the crop rotations and resulting vegetative cover; the conservation practices, terracing, contour farming, and grassed waterways; and pasture and timber land management.

Design of Earth Dams

The majority of small dams in this area are the simple embank-

ment type, constructed by the rolled fill method. When the foundation investigation shows sand and gravel or other pervious material within a few feet of the surface a core trench is dug along the center line of the fill and back-filled with relatively impervious material, usually the same material as is used to construct the dam. The core trench must extend down into the impervious material underlying the dam. The trench must have a minimum width of 4 ft. at the bottom and a side slope not greater than 1:1 to insure adequate bond between the foundation and the fill material.

The entire foundation area is stripped of all trees, shrubs, stumps and organic soil. The organic soil may be used as top dressing for the finished dam. The fill material is placed in 8-inch layers with a scraper or dozer, and rolled with a sheepfoot roller. As the fill is constructed compaction tests are made to insure 90 percent of maximum standard Proctor density. When the fill has been built up to the elevation of the conduit, or principal spillway, placement of fill material is halted and the conduit is installed on the compacted fill. If the conduit is of concrete, a period of seven days is required before construction of the fill can be continued. Hand tamping is required on all fill material within two feet of the concrete surfaces. The dams usually are

constructed with $2\frac{1}{2}$:1 sideslopes, and an 8-ft. berm is placed at the inlet of the principal spillway on the upstream side. If the dam is 40 feet or more in height, an 8-foot berm is placed on the downstream face near the center of the slope. Top width is 14 feet if the dam is 25 feet or more high. The surface of the finished dam is fertilized and seeded with a permanent grass mixture.

Principal Spillway for Detention Dams

The conduit through the earth dam is also known as the principal spillway. The smaller sizes are usually reinforced concrete pipe. The most common sizes are from 15 to 42 inches. For larger sizes, monolithic reinforced concrete is used. The size of conduit is selected to give the desired discharge.

The principal spillway consists of an inlet, a barrel and an outlet. The two types of inlets in general use are the box drop and the hooded types. The box drop inlet is usually a concrete box with the conduit built into one side at the bottom. The box has an anti-vortex wall on the side next to the earth fill to prevent a vortex from forming above the inlet. The purpose of the drop inlet is to insure that enough water enters the pipe to make it flow full. The hooded inlet is a recent development and has been used mostly on small metal pipes. The inlet end of the conduit is cut at an angle with the point on the top of the pipe. From this point the cut slopes to the bottom at a distance three-fourths of a diameter from the end. This type inlet will cause the conduit to flow full with a head of about 1.3 diameters, depending on the slope of the conduit. A steel plate is fastened to the top of the hood to prevent a vortex from forming above the inlet.

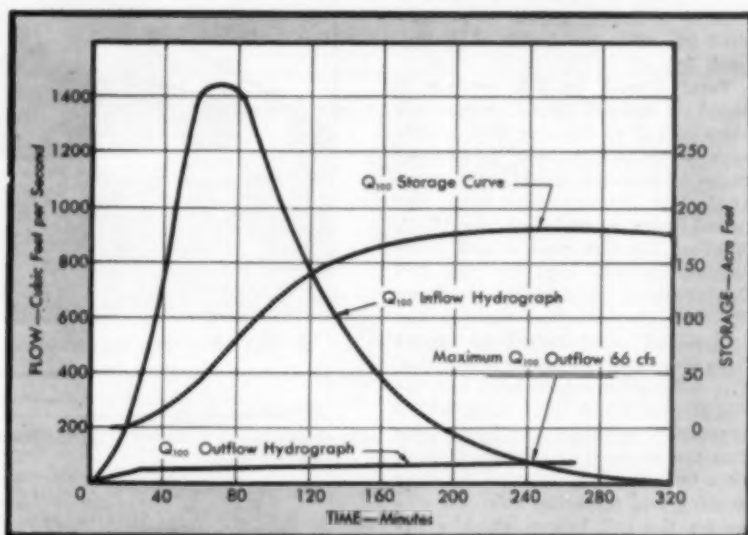
The barrel extends from the inlet to near the toe of the earth fill. It is constructed with water-tight joints and must not leak under full pressure. The outlet is usually one of three types depending on the condition of the stream bed below the dam: 1) The cantilever outlet; 2) the chute outlet and 3) the energy dissipator. The cantilever outlet is used on a pipe conduit when the stream bed is considered stable or slightly erosive. This consists of a bent constructed at the toe of the fill with the conduit resting on it and extending for a minimum distance of 8 feet below the toe of the fill. The chute outlet is used when there is a possibility that

the stream below may silt up or be filled to a higher grade. In this case the principal spillway barrel is extended out of the fill at a safe elevation above the expected fill and a chute is constructed to carry the discharge water from the barrel to the stream bed at the toe of the earth fill.

The outlet usually used on the monolithic reinforced concrete spillway is the energy dissipator. In this type a system of blocks is constructed on the floor of the outlet. These blocks are of a size and height and arranged to reduce the velocity of the water before it enters the stream below.

One cause for failure of small earth dams is overtopping during major storm runoff. It may not be economical to build a small dam and principal spillway large enough to handle the largest possible storm. The problem is best solved by designing the principal spillway on the dam to handle a storm that may occur once in 25, 50 or 100 years, depending on the size and the degree of hazard in case of failure, and then adding an emergency spill-

the outside of the principal spillway or conduit. It may be through the compacted fill or through the original ground under or in the abutment of the dam. If this seepage reaches the downstream face of the dam, it can cause erosion and sloughing and eventual failure. Seepage through the original ground may sometimes be prevented by a core trench filled with impervious material. Seepage along the conduit is controlled by use of anti-seep collars. These collars are fastened to the conduit with watertight joints. In addition to these precautions, a toe drainage system is installed in all dams in the Little Sioux River Basin. The toe drain usually consists of a 6-inch perforated corrugated metal pipe embedded in a $3\frac{1}{2}$ -ft. by $3\frac{1}{2}$ -ft. trench backfilled with a mixture of sand and gravel. This pipe is a minimum of 40 feet long and is usually parallel to the centerline of the fill. It is located about one-third the distance from the toe of the downstream slope to the inlet of the principal spillway. It has a pipe outlet to a point below the toe of the downstream slope.



● FLOOD ROUTING for the Lum Hollow subwatershed example discussed in the text. Peak temporary storage of 182 acre-feet occurs when outflow equals inflow.

way to handle what runoff there may be in excess of the design storm. For small earth dams the emergency spillway is usually a vegetated channel constructed at the end of the dam to carry the excess runoff around the dam and discharge it without damage to the embankment.

Another common cause of failure of earth dams is seepage through the embankment. It may be along

In soil conservation work there are many small dams constructed for the purpose of grade stabilization. There may or may not be a permanent pond above these dams. The spillway for this type is constructed to carry the peak flow of the design storm. These spillways are usually constructed of reinforced concrete. There are two types in general use. If the fall through the structure is about ten feet or

more, the chute type is used, but if it is less than ten feet, a drop spillway is used.

The chute consists of an inlet, the channel and the outlet. The inlet is constructed as a weir of a size that will carry the peak flow of the design storm. The channel is rectangular in shape and is constructed on a 3:1 slope. The outlet generally is constructed as an energy dissipator to reduce the velocity of the water as it enters the stream below.

In the drop spillway the inlet is a weir designed to pass the peak flow of the design storm. The outlet consists of a floor or apron, side walls and an end sill. The water passes through the weir and falls to the apron and passes over the end sill into the stream below. The wing walls are flared out at a 45 degree angle at the outlet. This prevents eddies from forming along the stream banks near the outlet and prevents erosion of the downstream channel banks near the structure.

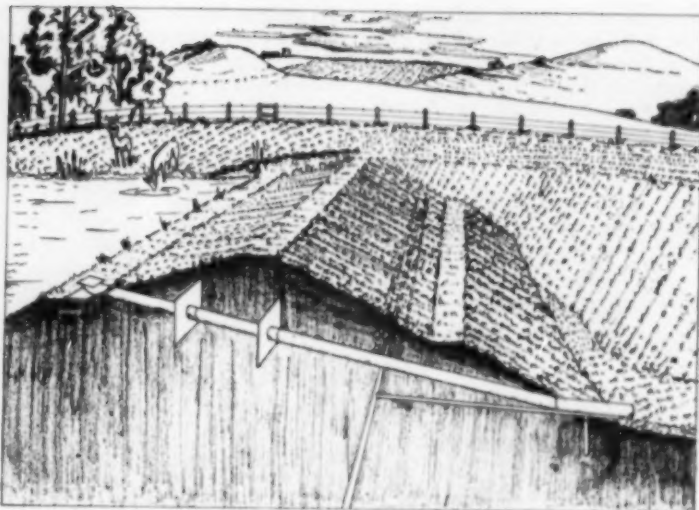
Typical Examples

A typical detention-type dam is located in Lum Hollow subwatershed five miles northwest of Smithland, Iowa.

Total Runoff in this section is based on a total rainfall for a six-hour period as follows: For a 100-year storm 4.8 inches, a 50-year storm 4.4 inches and a 25-year storm 3.9 inches. These values were obtained from a study of the U. S. Weather Bureau reports and from rainfall records kept by the Soil Conservation Service. Research by the Soil Conservation Service has determined what runoff to expect from storms of the above intensities. The infiltration rate is high and the runoff rate is low from fields where vegetation is heavy and from fields that are terraced or contour farmed. This is because vegetation, contour farming and terracing hold the water on the soil longer, thereby increasing the total infiltration.

Considering the example of the detention structure in the Lum Hollow subwatershed: The drainage area is 951 acres. There are 548 acres of cropland with the expected predominant 3-year rotation of corn, oats and meadow, and contour farming. There are 380 acres of permanent meadow and pasture with 238 acres level terraced. There are 23 acres of buildings, lots and roads.

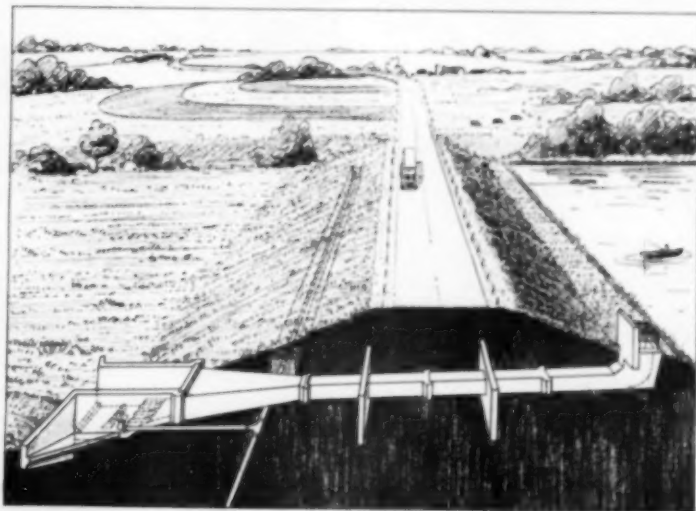
For a 100-year storm with 4.8 inches of rainfall we estimate that the runoff will be 3.03 inches from the cropland, 2.54 inches from the



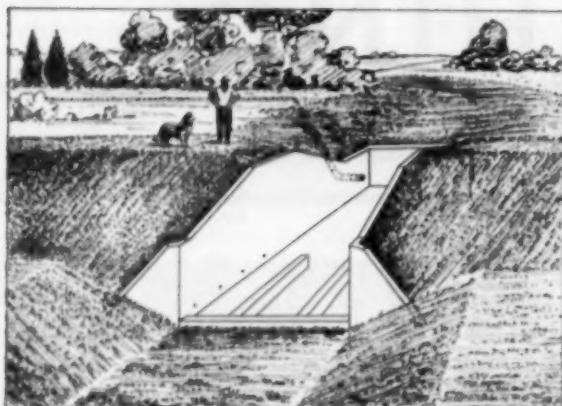
● THIS spillway has a hooded inlet, pipe barrel and cantilever outlet.



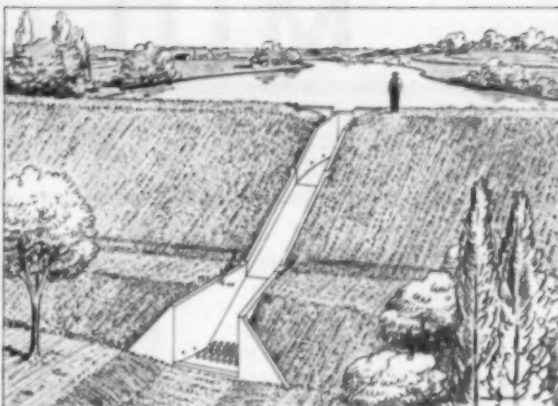
● BOX DROP inlet has anti-vortex wall. Chute outlet protects toe of dam.



● SPILLWAY with energy dissipator on outlet. Collars prevent seepage.



● **BOX-INLET drop spillway.** This type of spillway is preferred for dams when fall through the structure is less than 10 feet.



● **CHUTE-TYPE spillway.** Inlet weir is designed for peak flows. Note energy dissipator at toe and flared wing walls.

permanent meadow and pasture and 3.38 inches from the buildings, lots and roads. This results in 2.84 inches for the entire watershed.

Of the 951 acres 238 acres are terraced with level terraces with a holding capacity of 1.0 inches of water. The resulting runoff from this terraced area is then 1.84 inches.

The unterraced area of 713 acres has an estimated runoff of $713 \times 2.84/12 = 168.7$ ac. ft. and the terraced area of 238 acres has an estimated runoff of $238 \times 1.84/12 = 36.5$ ac. ft. Total runoff for the watershed of 951 acres during a 100-yr. storm is thus 205.2 ac. ft.

The peak inflow is 1,450 cfs. Near the end of the storm there are 182 ac. ft. of temporary water storage. Maximum stage above crest is 12.1 feet. Freeboard at this stage is 2.4 feet.

Sediment Yield. Research by the Soil Conservation Service has determined what soil movement to expect from each type of soil during a year of average rainfall. The crop rotation and resulting vegetative cover is a controlling factor in soil loss because much more soil is lost from a clean tilled field than from the same field in meadow or good pasture. Farming practices are a controlling factor because much less soil is lost from a field that is contour farmed or terraced than from the same field that is clean tilled with straight rows.

Considering the typical detention structure in the Lum Hollow subwatershed, the estimated sediment accumulation in the next 50 years is 56 ac. ft. This was determined as follows: Land use of the 951 acres; 548 acres corn, oats, meadow, rotation, 10 percent average slope, 260 feet average length; 403 acres permanent meadow, pasture and miscellaneous; 238 acres are level

terraced. Calculations for sheet erosion are given in Exhibit 1.

Gully erosion is considered negligible because it is assumed that there will be no active gullies developed within the watershed within the next 50 years.

Of this sheet erosion of 5,591 tons/sq.mi./yr. only a part will reach the detention pool. Some will be deposited at the lower end of the steeper slopes and at other

places where the velocity of the runoff water decreases. The factors to consider in calculating the amount to be deposited in the detention pool are (1) size of the watershed (2) period of time considered (3) total erosion (4) the capacity of watershed ratio or total storage (temporary water storage plus sediment storage) divided by area of watershed in sq. mi. The
(Continued on page 194)

Exhibit 1—Calculation to Determine Sheet Erosion

Land Use	Portion of Watershed		Rotation Factor		Unit rate of Sheet Erosion Tons/sq.m./yr.		Total Tons Sheet Erosion Per Sq. Mi. Per Yr.
Clean-tilled and Small grain	$\frac{365}{951}$	x	1.5	x	9,350	=	5,376
Other Use Including Rotation Hay	$\frac{586}{951}$			x	350	=	215
Total sheet erosion =							5,591

Exhibit 2—Calculation of Sediment Deposited

$$S = 100W^{0.7084} T^{0.7867} E^{1.0845} (C_t/W)^{0.3701/817.9}$$

where S = total tons of soil deposited

W = net drainage area, sq. mi.

T = life, years

E = rate of erosion, tons/sq. mi./yr.

C_t/W = ratio of watershed capacity, acre feet total storage capacity per sq. mi. of drainage area

The above formula may be applied to the detention structure in the Lum Hollow subwatershed to determine the sediment accumulation. Here the net drainage area, W, is 971 acres or 1.486 sq. mi.; design life, T, is 50 years; and the rate of erosion, E, is 5,591 tons/sq. mi./yr., as determined in Exhibit 1. C_t , the total storage capacity, consists of temporary water storage plus sediment storage. The latter is assumed to be 70 acre feet and the maximum temporary water storage is 182 acre feet; hence $C_t = 182 + 70 = 252$ acre feet. By substituting in the formula it is determined that the total soil deposited is 73,180 tons.

The specific weight of sediment in a detention pool is considered to be 60 lbs. per cu. ft. Then the volume required for 73,180 tons is $73,180 \times 2,000/60/43,560 = 56$ ac. ft.

MULCHING

SEEDED AREAS

WILBUR J. GARMHAUSEN

Chief Landscape Architect
Ohio Department of Highways

MULCHING first became an important part of Ohio's successful highway seeding operations in 1938. The previous year a disastrous Ohio River flood forced the highway department to do extensive repair seeding operations at a time other than the accepted good seeding dates. In order to protect these newly seeded areas a straw mulch was placed over them. We recognized that a good turf could be established without the use of top soil if fertilizers and lime, when required, were used along with the mulch. However it was necessary to keep this mulch "in place" against wind, rain and backlash of traffic movement until such time that the turf had become established. Just how this was to be accomplished no one knew exactly and so followed a period of trial and error.

At first branches or boughs from saplings were laid along the berm of the road. This method was successful only directly beneath the



● **MULCH** reduces erosion, as is shown by this picture. Area at left was not protected. Mulch lessens evaporation, keeps the seed bed loose and adds organic matter.

branches. It made the roadside unsightly and in some instances created traffic hazards. Soil was tried next. Scattering the soil over the straw kept more of the straw in

place than the branches had but this was a slow and costly procedure and there was no assurance that just the right amount of soil would be used to cover an area. It was found that the distribution was very uneven and in most instances too heavy an application had been made.

The next step was to devise a very detailed arrangement of twine which was kept in place by wooden pegs and wire staples. This was used to tie down all of the mulch not only on the berms but also on all slopes and ditches. This practice is still accepted in our present roadside seeding specifications, but is generally used by the seeding contractor only on very small projects or in special places.

Mulch soon became an accepted part of Ohio's roadside seeding practices. It remained for us to apply and secure by more efficient and economical methods through mechanization. Our first effort was the use of a sheepfoot roller over the newly mulched areas to punch the straw into the soil. While this operation did help, we could not feel that it was efficient since much of the straw was still not secured. We also experimented with a farm-type disk



● **THICKER** layer of straw is necessary if the project is to go through a dormant seeding period. After germination, refertilization of the area will be necessary.

to incorporate sufficient mulch into the soil to hold it in place. In order to make this operation successful a loose seed bed had to be prepared and the straw used had to be of such quality that it would not be cut in two.

Still not satisfied, we began to use a rotary-type mixing machine (which in effect is a large rototiller) to incorporate sufficient soil into the mulch to keep it in place. The machine was usually set so that it would cut into the seed bed to an average depth of one inch which was sufficient to secure the straw. Our first projects were fraught with concern as to what the cutting of one inch would do to the seeds. Results definitely proved that the seed bed was left sufficiently loose and that seed germination was not hampered and good stands of turf were obtained.

A series of experiments were also tried using asphalt to keep the straw in place. The first method was to spray a light application of the asphalt over the straw, either by a straight line application or by a wavy cross pattern. We used cut-back asphalts (RC-1, RC-2 or RC-3) or emulsifiable asphalts, (RS-1, RS-2 or MS-2) depending upon the availability of the material. A plain asphalt mulch is now carried in our specifications. After proper soil preparation, seeding, fertilizing, rolling and watering, a thin film of asphalt material is sprayed onto the seeded area at the rate of 0.2 gal. per sq. yd. and at a temperature not to exceed 150°F. It is used in special areas to hold the soil in place until the seed germinates and the seedlings break through the asphalt covering. It is useful where the danger of fire is a consideration or where a straw mulch would be hard to keep in place because of pedestrian traffic or other factors. This practice has its limitations if the seeding is done so that it will have to carry over winter. The asphalt breaks down and allows erosion to take place before turf can be established. It is very satisfactory when used during the summer months.

As the value of mulching in roadside erosion control became widely recognized it was apparent that the slowness and costliness of operation limited its widespread use. This limitation was overcome by mechanization of mulching operations as mulch blowers of various kinds were developed.

Equipment Development

The earlier machines were glorified silage cutters with the cutter

blades removed. While they put the mulch on the seeded areas and increased the daily output of mulched areas, as many men were used to break up the bales of straw and feed the machine as were used in hand applying mulch.

Modern equipment in one operation covers the seeded areas evenly and economically with straw mulch and simultaneously sprays the mulch with an asphalt emulsion that provides a tack to the straw which keeps it in place. Not only does this machine cut costs but shorter straw from modern combines can be used since the blower method results in an interlocking of mulch particles and gives a smooth uniform application that is not possible by hand.



● LATEST method employs a power mulcher which not only covers the seeded areas evenly and economically, but also sprays the mulch with asphalt emulsion as a tack.

Straw mulch was first used on highway seeding to protect those areas from erosion. We have continued to use it because it has successfully extended our seeding season. As highway construction projects are completed at all times during the year, we have allowed seeding to be done at any time of the year that a proper seed bed can be secured. Usually a thicker amount of straw is required if the project is to go through a dormant seeding period. After germination a re-fertilization of the area is necessary. Results are sufficient to offset holding the contract open until the most reliable seeding season.

Enthusiasm for the use of mulches is apparent in many sections of our country. The best thinking has agreed that mulch is of great benefit because it reduces erosion; it reduces the force of raindrops; it

reduces evaporation; it keeps the seed bed loose and at a more even soil temperature; and it eventually adds organic matter to the soil. Mulch shades the seedlings allowing some sunlight to penetrate and air to circulate and it encourages and hastens native growth in areas that have not been seeded.

Other Mulches

Besides grain mulches, many other kinds of mulching material have been used. Baker Bark, Pay Gro (lumber and pulp mill by-products of bark or bark and slabwood) and other types of mulches of sawdust, ground corncobs, latex and plastic products are applied. Some of these mulches are used only in certain

localities because of cost and availability. A number of new synthetic mulches as well as a paper mulch, now available, are worthy of consideration. Hay mulch has given very good results especially when clover or crown vetch hay has been used. This mature threshed hay which still contains some seed is spread over areas that need re-seeding or fortifying to provide the type of cover desired. It has the advantage of combining several operations in one besides providing its own seed inoculant. Fertilization is always recommended with this type of mulching.

Mats of various materials have been used in special areas such as steep slopes which are inaccessible to mechanized equipment and too steep to work by hand labor. Some of the mat-type erosion control materials we have tried are straw mats,

erosion netting, wire mesh and grass mats.

All mulching methods have not been satisfactory. There was the case of an early synthetic resin that didn't work in practice. In theory it was hoped to be a one-time application operation in which the resin, seed and fertilizer were suspended in water and then sprayed on the area to be seeded. The resin was to form a thin film over the soil to prevent erosion and to serve as a cover for the seed until it germinated. The reason for its failure was that this particular resin dried out the top inch of soil, allowing no moisture for the seedlings which consequently died. We also have had our problems with vegetative mulches. One of our earlier concerns was that of the vegetative mulch catching on fire. That danger is always present although through the years of using mulch, experience seems to

indicate a lesser fire hazard than first thought. It might be said that vegetative mulches have other disadvantages such as becoming a haven for insect pests and also a source of weeds. Another problem is that before it decomposes sufficiently to become organic matter it uses nitrogen from the soil and generally decreases the amount of nitrogen available for turf establishment. This we counteract by the addition of a higher nitrogen analysis fertilizer.

Ohio Specifications

Wheat straw is the most widely used mulch in Ohio because of its availability and length. We have found that the longer straw stays in place the better. Straw can be bought in quantity in bales which are easily transported, stored and handled.

It is hard to reach a satisfactory uniform recommendation on the rate

of application of straw mulch due to the variation in condition of the straw plus the physical conditions of soil and temperature. Our specifications call for application of one and one-half to two tons of straw per acre or application two inches in depth (loose measurement). It is up to the Division Landscape Architect to advise the contractor what rate is required for the particular roadside conditions.

As new types of mulches and new equipment are developed who knows what material or method may be devised that will be entirely different from anything tried to date. With what has transpired in the past and the hope the future holds, I am sure that techniques will improve and satisfactory protection will be provided for our seeded areas so that our roadsides will be pleasing and truly the front yard of our State.

SIMPLIFIED SEWER DESIGN

ABOUT three years ago we worked out a method of simplifying our sewer design which has proven quite effective and practical. We have used it to extend and modify our storm and sanitary sewer systems with a considerable saving of time, both in original design and checking of the existing system.

The idea is simply equating area to quantity of both sanitary and storm flow and superimposing the information on any one of a number of sewer design charts, slide rules or nomographs available. Perhaps a similar system has been developed in a number of communities; however, the system is new to us and possibly can be of help to someone else.

We selected a diagram based on Kutter's formula $n=0.013$ as it seemed to suit best the type of material, velocities and sewer sizes with which we expected to work and is easy to use.

As in most communities of similar size, we are limited by budget to two professional engineers. Outside consultant advice is obtained only

R. B. STEYTLER

City Engineer,

Erie, Pennsylvania

when a clear cut need is established. For the everyday work of revamping and extending our sewer system, it became imperative to give our draftsman a method less complicated than standard design procedures and, more important, one that is not based on an uneducated guess of what future development might occur in our undeveloped drainage areas.

The history of Erie's growth points up the problem of the need for adequate design. The original area of the City was successively doubled in 1848, in 1870 and in 1919. A consistent increase in population up to the present time has followed these patterns.

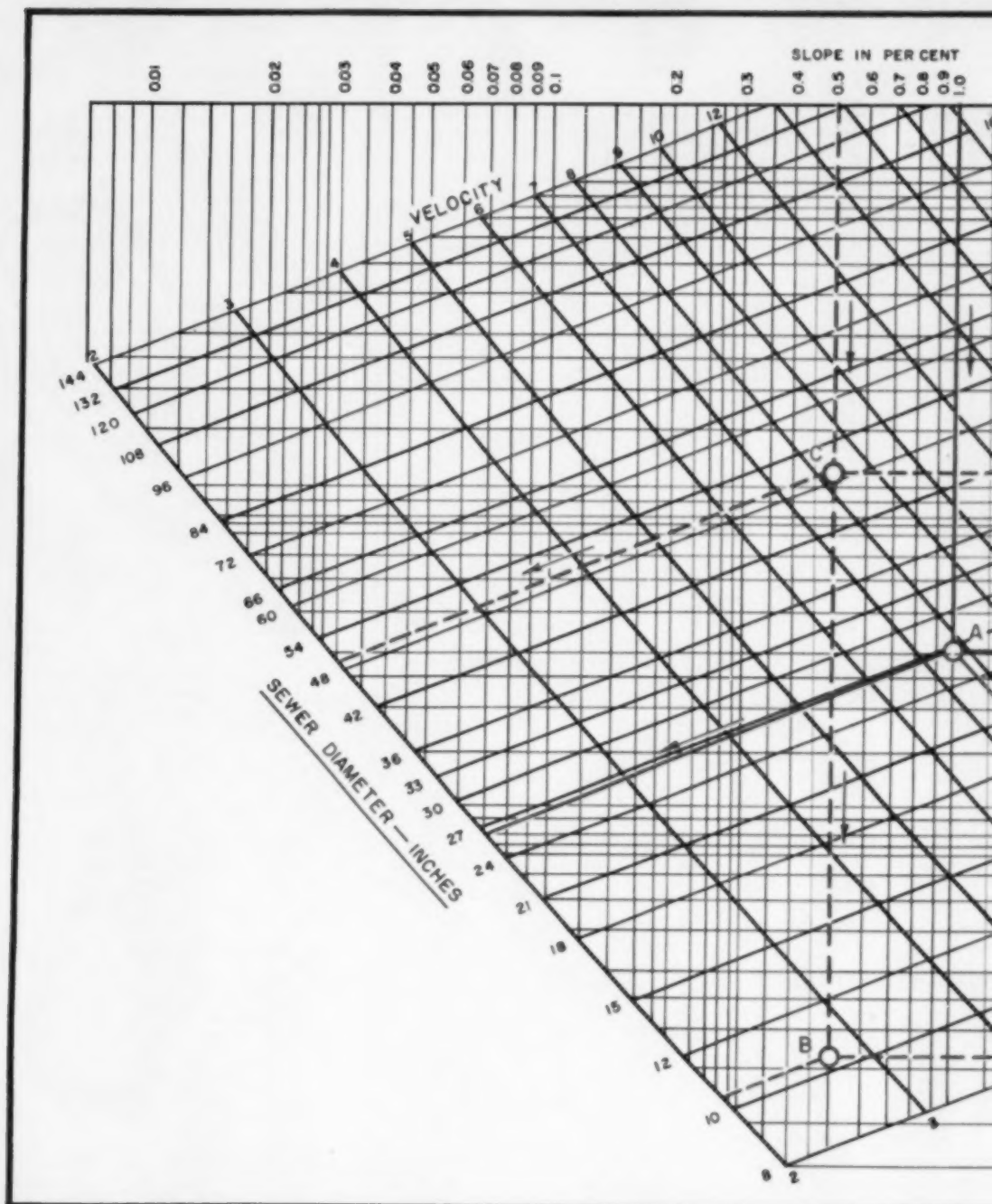
A study of the sewer system shows that an effort was made through the years to guess the correct sewer sizes; however, reports

made by consulting engineers in 1930 and 1951, showed portions of the original sewer system to be of inadequate capacity. A post card survey in 1951 revealed areas subject to flooding and backing up of sanitary sewage throughout the city, but most of them were concentrated at the low areas around the original city limits.

It is fairly obvious that the early designing did not take into consideration the future potential of the drainage areas; probably the sewers were designed to accommodate only immediate needs.

Before I am accused of pointing a finger at my home town or our early engineers, let me say that history reveals this situation to be pretty common. The same problem, only more intensified were apparent in London and Paris in the middle 1800's and text books show that the adequacy of the famous sewer system in Hamburg, Germany is mostly the result of a large fire which destroyed the older section of the city and allowed for the replacement of the existing underdesigned sewer system.

STANDARD SEWER DESIGN—Bureau of



NOTES: Based on Kutter's Formula $n=0.013$
 Minimum rainfall 2.1 inches/hour (15-year)
 Minimum sanitary sewage 250 gallons/capita/day

DO NOT USE FOR: 1. Drainage areas where length is less than twice the width; 2. Excess runoff from paved parking lots or large roof areas; 3. Industry using excessive water.

USE FOR: 1. All domestic areas; 2. Commercial and light industrial areas with sufficient lawn area to retain storm water.

EXAMPLE A:

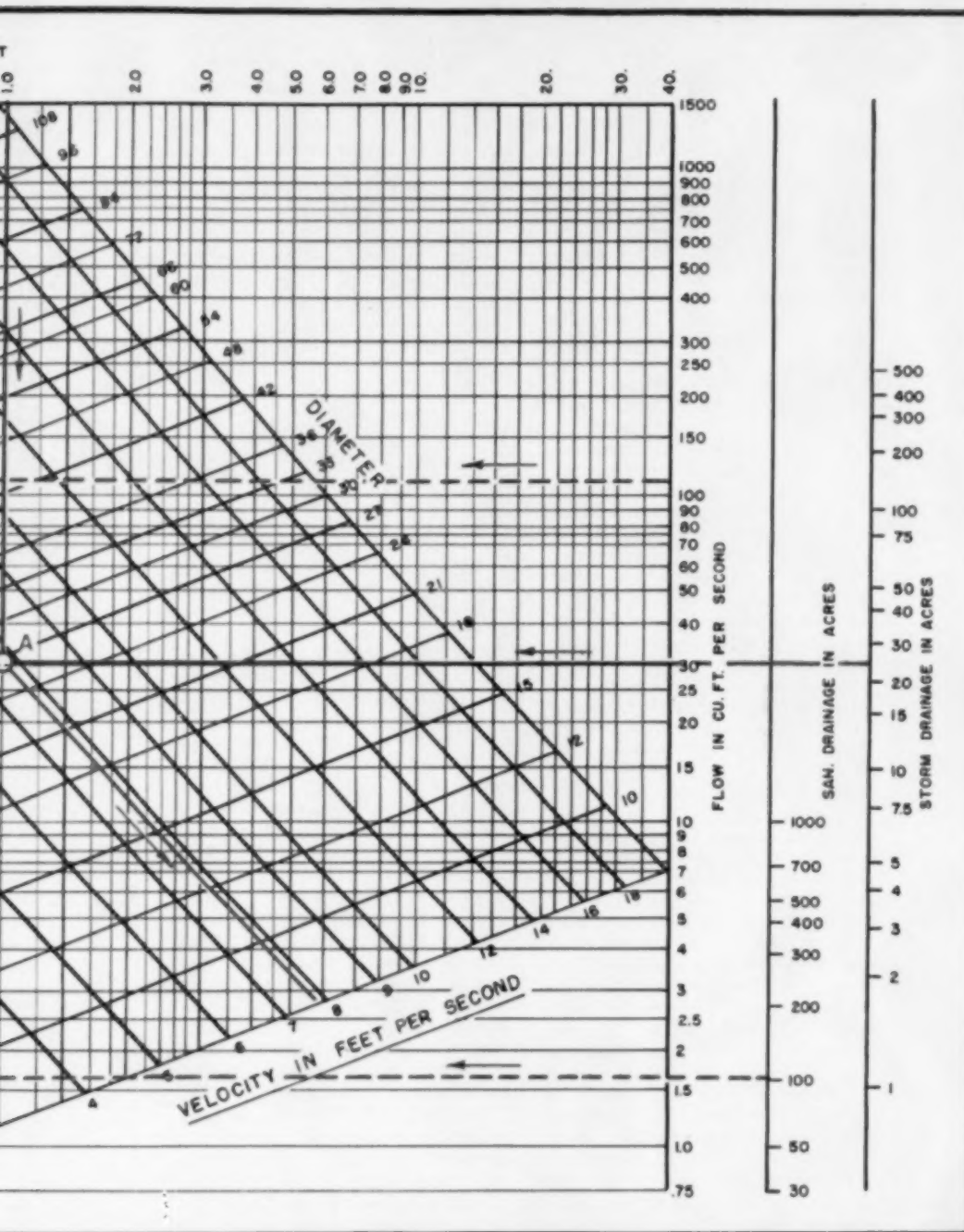
Given: 25-acre storm drainage area in width ratio 3 to 1; 1 percent slope.

Read from chart: Use 27-in. sewer. (Velocity 6.5 ft/sec)

EXAMPLE B:

Given: 100-acre area; width 1500 ft.; slope 0.0015 ft/ft. (1.5 percent)
 sewer size.

of Engineering, Erie, Pennsylvania



in residential property; length-to-slope. Find storm sewer size.

(Velocity is nearly 8 ft./sec.).

ft.; slope 0.5 percent. Find sanitary

Read from chart: Sanitary sewer size between 10 and 12 ins.; use 12-in.

EXAMPLE C:

Given: Same area as Example B. Find storm sewer size.

Note: Length is less than twice width, therefore consider two 50-acre areas. As read from scales on chart, flow from 50 acres is about 55 cfs. Total design flow will be 110 cfs.

Read from chart: Storm sewer size between 48 and 54 ins.; use 54-in.

In developing a standard design for all sewers we must realize there are certain fallacies in the procedure and correct for them. The coefficient of storm runoff, population densities, industrial loads and concentration times are all variable factors. Our main argument to offset these factors, which are individual in each separate design, is that we do not know what future use will be made of our undeveloped areas even if we should design each sewer separately. Further, in using a minimum 8-in. size for sanitary sewers and 12-in. for storm sewers, we can increase capacity materially with only a small increase in cost. This leads to a tendency to overdesign. It may be called wasteful but the building of one large shopping center or a larger water using industry near the top of one of our drainage basins in the future would cost considerably more in sewer replacement than any present overdesign.

The storm sewer design is based on the rational formula $Q = Aci$ in which the quantity of storm runoff in cfs is considered the product of the area of the watershed in acres; the coefficient of runoff, which is a measure of the amount of rainfall that enters the sewer; and the intensity of rainfall in inches per hour for the period of time required for the water in the drainage area to enter and fill the sewer at the point of design.

As an example, for an area of two acres with a coefficient of runoff of 0.3, it may be assumed that a minimum of eight minutes is required for the storm water to collect in the system from the first acre; and assuming a velocity of 5 fps for an acre of ground about 150 ft. by 300 ft., one minute is the length of time necessary for the water to travel through the storm sewer. On our rainfall intensity chart, this nine-minute concentration time indicates an intensity of 5.4 inches of rain per hour at a 15-year frequency. The resulting calculation of Q is $2 \times 0.3 \times 5.4$ or 3.24 cfs.

In developing the larger size sewers, a number of factors enter into the design. The general topography of the area around Erie consists of a gentle slope which rises from the lake in the north to a plateau at the south of the drainage areas. The economic design of our storm sewer system then is such that, as the drainage areas increase in size, they tend to become long and narrow. Further, the general development of larger lawn areas and gentler slopes to the south as

well as the longer length of sewer involved leads to an increased amount of concentration time for the water to collect and the sewers to become filled. An attempt is made in these larger areas to develop an economically sized sewer system that will handle safely this average type drainage basin. A method of using a constant concentration time per acre in predicting the rainfall intensities was selected as best reflecting our situation. Furthermore, an increasing coefficient of runoff was considered necessary as a safety factor, which becomes more important as the sizes of the areas increase. It was decided to add one minute to the concentration time for each additional acre in determining the rainfall intensity and to increase gradually the coefficient of runoff from 0.3 at one acre to 0.5 at 50 acres and 0.7 at 100 acres. A check against a typical 50-acre drainage area, 3000 feet by 700 feet, using a 15-minute concentration time indicates a rainfall intensity of 3.2 under conventional design and 3.7 by using the above described method. A 15 percent factor of safety is provided in this example.

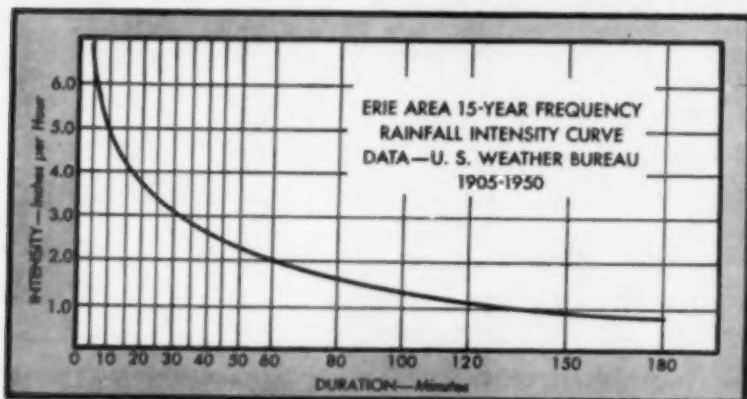
The factor increases as the area becomes narrower. A check against conventional design at 100 acres indicates that with a drainage area only one block wide a safety factor of 100 percent would result. When the width is half the length, the factor is about 5 percent. Should a 100-acre drainage area have a length to width ratio of 2 to 1 or be 3000 feet by 1500 feet, the safety factor is only 15 percent.

After having checked this design method against a conventional design for a number of probable drainage areas, a series of calculations were made using the assumed detention periods and runoff coefficients. The drainage areas were plotted on the chart opposite the corresponding quantities of sewer flow.

For normal design, under 50 acres of drainage area, the use of the chart should result in a safe economic design if the width of the area is less than half the length. As the drainage areas increase in size, the width to length ratio becomes more critical and no drainage area over 1000 feet wide is worked directly from the chart. The method in the wider drainage areas consists of dividing the total area into two or more smaller areas which are within the scope of the basic design length-to-width ratios, and totaling the quantity of storm water, as read from the chart for the smaller

area, to a flow expected from the total area. The size and slope of the storm sewer then is read from the chart opposite the quantity of storm water rather than opposite the area.

It must be pointed out that the chart is designed for the minimum size storm sewers that can be considered economically safe in the City of Erie. The runoff coefficient of 0.3 might be considered inadequate somewhere else and is used here only because the growth of the City is such that heavy industrial and commercial districts are located near the lake at the lower end of the drainage area where they do not affect the areas designed by the chart.



● RAINFALL intensity curve used for storm sewer design in Erie, Pennsylvania.

That particular type of area is subject to separate design as are areas over 500 acres in size.

The chart is based on an average condition in Erie and should such a chart be made up for another City it is quite possible that the local design considerations could result in an entirely different set of figures than those used here.

Sanitary Sewer Design

The sanitary portion of the chart was designed strictly on a population basis, with a sufficient safety factor to lead to an over-design. The design of sanitary sewers differs from storm sewers in that even one overload in fifty years is once too often. Our minimum sewer size of eight inches at our minimum velocity of 2 fps results in a flow of 0.75 cfs or 480,000 gpd. A design of 400 gpd is used for this minimum sewer. Our minimum lot size is 4,000 sq. ft. We make a safe assumption, neglecting streets, of 10 lots per acre. At 4 people per lot the computation results in 16,000 gallons per acre per day. The minimum sewer then would serve 30 acres as shown on the chart.

The maximum sewer design is

based on the sewage treatment plant record which shows an overall average of about 150 gpd in the sewered areas; from other records, a population density of about 23 persons per acre is developed. Our minimum design, at 1000 acres, is actually calculated by using a per capita rate of 250 gallons per day with a population density of 25 persons per acre. The areas in between are estimated at a population density of 25 persons per acre, using a rate of 450 gpd at 100 acres, 350 gpd at 250 acres and 300 gpd at 500 acres. We know that the minimum of 16,000 gpd over 30 acres is sufficient to care for industry in our minimum

sewer size and that, by not considering the time of concentration and considering that our peak industrial load does not occur with our peak sanitary load, we feel that a safe industrial design results.

Use of the Chart

The use of the chart, after its development is quite simple. The first step is a computation of drainage area which can be done fairly easily from contour maps. The important part here is that the entire area that can possibly drain into the sewer must be considered. A simple master plan outlining these areas can be developed to aid the draftsman. The various sewer sizes, slopes and corresponding velocities can be read directly from the chart. The correct size is determined from a study of the ground contour, available fall and velocity. It is not only important to develop a velocity of over two feet per second but further to design on an increased velocity basis so that there will be no abrupt drop in velocity in the system that would tend to deposit heavier particles and clog the sewer.

For example let us assume that, at the point of design, we have a

potential contributing area of 25 acres of residentially zoned property with a length to width ratio of three to one. A study of the contours reveals a one percent slope.

Reading across from the storm drainage area of 25 acres and downward from the slope of one percent we find a 27-inch sewer is indicated. Reading diagonally from this point we find a velocity of close to eight feet per second is indicated when the sewer is flowing half-full or full. The velocity is high enough to discourage settling in the sewer and the 27-inch size is selected.

For the sanitary sewer to serve the same area the chart shows that the minimum size sewer of eight inches at the one percent slope is more than ample to serve the area.

For another example let us assume a one-half percent slope and a drainage area of 100 acres with a width of 1500 feet.

For the sanitary sewer size we find the intersection of a line drawn across from the 100 acres and a line drawn down from 0.5 percent slope indicates a 12-inch sanitary sewer as the minimum size.

For the storm sewer, because of the excessive width, we consider two areas of 50 acres each. The flow from each 50-acre area, as read from the chart, is about 55 cfs and a total design flow of storm water of 110 cfs is indicated. Reading across from the quantity of 110 cfs and down from the slope of one-half percent we find a 54-in. sewer is indicated.

The overall results we expect from our future sewer system will be a limited number of short duration, small-area flooded conditions at the inlets every five years or so and complete adequacy of the sanitary system. As the storm sewer areas increase, the probabilities of any overload decrease until, under separate design, the largest sewers should still have reserve capacity.

While the calculations and intentions of the sewer design chart is to overdesign, it is still necessary for the final design to be checked by a competent engineer. Generally the only work necessary in checking is to determine if the area under consideration is similar to that for which the chart was developed and includes all of the potential drainage basin. The rule here is to go to the next largest sewer size in any questionable area.

I am sure that this type of chart is used in other areas; however, since the idea is new to us, I feel that this information could be as useful to someone else as it has been to us.



● LIME slurry was prepared with 53 bags of lime to 230 gals. of water and applied by a spreader.

Lime Stabilization CORRECTS BAD SUBGRADE

THE OLD AXIOM that no road is stronger than its base has led the City of Hillsboro, Kansas, to use lime stabilization where bad clay subgrades are encountered in street construction. Last year the city let a contract for resurfacing about 20 blocks partly in a new subdivision. The original contract called for 6 in. of asphaltic concrete to be placed on the existing roadway. Rhoades Construction Co., Newton, Kansas, was the contractor, and H. B. Russell, Wichita, Kansas, was the consulting engineer on the project.

Upon investigation of the existing roads, it was evident that bad subgrade conditions existed in certain areas, and that some form of subgrade correction was needed to insure a long-lasting pavement with low maintenance. Lime stabilization was suggested as a possibility by the contractor, who had previously built some parking lots and tennis courts in his own town using lime to upgrade in-place clay soils. Mr. Russell had seen some of this work in Newton and was impressed with the results. Accordingly, he had tests made of the existing subgrade material in Hillsboro, with varying percentages of hydrated lime being added to the soil. Of particular significance was the more than 100 percent reduction in the Plasticity Index (original PI was 40-45) attained with only 4 percent hydrated

lime (based on dry weight of soil). Also, the stabilized samples exhibited considerable strength gain.*

After the tests were completed, the city council held a meeting to consider Mr. Russell's recommendation to modify the original contract to include lime subgrade stabilization. The laboratory results and the advantages of using lime were discussed at the meeting, and colored movies and slides were shown of other stabilization projects in Kansas and surrounding states. After considering all the facts, the council voted to add lime to the Rhoades contract.

The construction project featured two innovations in stabilization practice—the use of a ready-mixed concrete truck to mix and deliver a thick lime slurry on the roadway, and the off-site mixing and stockpiling of lime-clay material to be used at intersections.

The slurry method was used in areas where homes had already been

constructed, in order to avoid complaints from blowing lime dust. In the more open areas, bagged lime was used, the bags being spotted in multiple rows to give a 4 percent distribution. After the bags were opened and dumped, the piles of lime were leveled with a grader. Then the lime and clay were mixed with a pull-type Seaman-Andwall Pulvimixer. Water was added during mixing and compaction to bring the soil to the optimum moisture content.

The slurry was prepared in a 3-cu. yd. ready-mix truck, the bagged lime being dumped in by hand. The mix consisted of 230 gal. of water to 1½ tons of lime (about 53 bags of lime); this yielded a heavy lime paste (about 58 percent solids). After mixing, the paste was discharged through the regular concrete chute into an Ezee Flow fertilizer spreader, which distributed the material evenly across the subgrade. Several spreading passes were required to distribute the proper amount of lime. After each spread, the lime was mixed into the soil with the Pulvimixer, which made one pass. After all the lime was placed, the Pulvimixer made two more passes to insure thorough mixing to a 6-in. depth. Compaction was handled by light pneumatic rollers.

It is interesting to note that this was perhaps the first time that such

*The reduction in plasticity is explained by a chemical reaction in which the larger calcium ions of the lime replace the smaller, weaker, sodium ions in the clay, thereby causing the clay to flocculate and become more friable. The strength increase comes through a cementing reaction occurring between the calcium from the lime and the alumina and silica of the clay; this reaction also renders the clay somewhat impervious to water.



● BAGGED lime was loaded by hand into a 3-cu. yd. ready mix truck. Resulting mix, a heavy lime paste, was applied to the road by successive passages of spreader.



● FOLLOWING each application of the lime, mixing was accomplished by one pass of the Pulvimixer; and after all lime was spread, Pulvimixer made two more passes.



● OFF-SITE mixing was also used where in-place stabilization was not applicable. Here a motor grader mixes dry lime with material excavated from intersections.

a heavy lime paste was used in road stabilization. On other slurry jobs, the typical mix has been 1 ton of lime to 500 gal. of water, yielding a 32 percent lime solution. This thinner-type slurry has been spread with conventional sprinkling trucks, using either gravity or pressure discharge. Heavier concentrations generally are not used since the slurry cannot be pumped readily (40 percent lime constitutes the maximum pumpable slurry). The ready-mix truck-fertilizer spreader combination, on the other hand, permits the use of a heavy paste. Because the past fall in Hillsboro was exceptionally wet, the use of a heavy paste rather than a thin slurry was helpful in drying out the clay and bringing it down to the optimum moisture content. Much of the job progress would have been impossible without effective control of moisture content in the subgrade provided through the use of lime.

Off-site mixing also proved to be an important innovation. This was done in conjunction with intersection work, where in many cases the grade of the older streets had to be changed to correspond with the new streets. In-place stabilization of such small areas as intersections would have been difficult. The off-site mixing occurred adjacent to the project, using material excavated from the intersections. After dry lime was added and mixed in, the material was stockpiled for later use. Because lime is slow setting, the treated material could be stockpiled for several days without losing the effects of stabilization. By replacing the treated material with raw clay excavated from the intersection, the contractor was able to reduce hauling costs, since his trucks were loaded both coming and going from the mixing site.

Prior to placing the 6-in. asphaltic concrete layer, the lime stabilized subgrade was damp cured for a period of 5 to 7 days. The city streets varied from 31 to 36 ft. in width (34-ft. average), with lime requirements amounting to approximately 12 tons per block. Because of the low lime requirement, the additional cost of the lime stabilization was a relatively small item in the total paving project. Furthermore, stabilization was considerably less expensive for correcting the bad subgrade than the usual method of excavation and replacement by better base material. Based on the success of Hillsboro's first lime stabilization project, it is anticipated that more jobs will materialize in the future.

SINGLE OPERATION PAINTS CENTER and EDGE LINES

B. H. BOWMAN

**Traffic and Safety Engineer
Ohio Turnpike Commission**

BY REVISING a large truck strip-er so that the centerline and left-hand edgeline could be applied in one simultaneous operation, the Ohio Turnpike Commission experienced a reduction of pavement marking costs in 1959. Not only was the pavement striping period shortened, with obvious savings, but Turnpike patrons enjoyed an additional safety factor in that they were guided by freshly painted lines at an earlier time than normal and before the heavy summer travel period. All mainline traffic lanes were completely marked by June 19th, an early date for pavement marking programs to be completed in a Northern state. Mainline painting on the Turnpike consists of a dashed 6-in. wide centerline, with two 4-in. wide continuous edgelines in each directional roadway. Twenty thousand gallons of paint and 60 tons of drop-on glass beads, were used for one complete pavement painting application.

The actual revision of the large truck strip-er (originally designed to apply single or multiple lines at one location at the rear of the strip-er) consisted of:

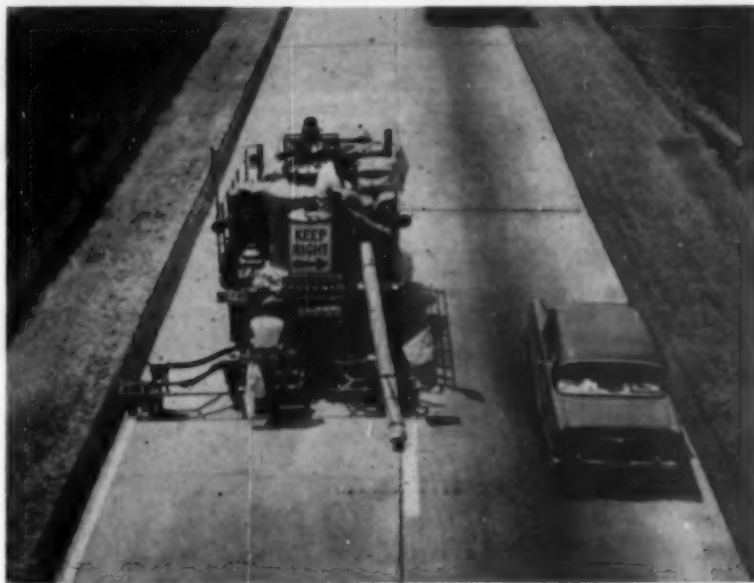
- 1) Building an outrigger to apply paint and beads at the left and right rear corners of the strip-er, just outside of the rear wheel tracks.

- 2) Installing a pressurized glass bead tank on the strip-er proper, to supply a constant flow of beads to all paint guns.

- 3) Installing dual controls in the truck cab so the driver could drive from either the left or the right side, depending upon which line was being painted.

- 4) Rearranging the long guide on the front of the strip-er so that it could be moved across the front of the strip-er from one side to the other.

Experience has taught that to get a straight painted line, the strip-er must have all wheels upon the pavement proper. Any operation where two wheels move on the shoulder and two on the pavement cannot result in a straight paint line. The strip-er is bound to experience some



● **TRAFFIC** moves with ease and safety while left edgeline and centerline are being painted on the Ohio Turnpike. The long chute on the right side of the equipment, fed by the workman on the truck bed, deposits safety cones on the fresh centerline.

variance in elevation on the shoulder side, thereby causing a weaving line of paint application. While all concrete pavement edges on the Ohio Turnpike appear to be very straight, it was found that these edges when used as a guide, were not as satisfactory as the sawed concrete joint in the center of each directional roadway. By adjusting the position of the driver, the outrigger and the front guide, all painted lines regardless of location are applied with the straight sawed center joint as the guiding element to follow.

When the two paint lines are being applied at one time it is possible to apply one thousand gallons of paint in a day's operation. This particular type of pavement paint application lends itself well to turnpikes and other expressways with divided roadways, such as the new interstate highway system, where the pavement widths are constant for long distances. There are two good reasons why the left instead of the right edgeline is applied simultaneously with the centerline:

- 1) The one-directional roadway lends itself to the closing of the passing lane rather than the driving lane for paint drying time. Traffic is

handled easier and safer in this manner, as less lane changing by traffic is necessary.

- 2) There are no breaks in the left-hand edgeline as all traffic leaves and enters the roadway on the right. Thus traffic entering and leaving does not pose a problem while the paint on the centerline and left edgeline is drying.

All striping operations are, of course, carried on with the strip-er moving with traffic. The right or outside edgeline is applied as a single operation, using the right outrigger gun only and does not require the closing of a lane to traffic during the paint drying time. Except for the placement of a limited number of "WET PAINT" signs over this outside edgeline no additional wet paint line protection is necessary.

One annual application of high grade paint will supply good lines that show up well the next spring. However, the painting must be accomplished quickly and as soon as weather permits in the spring if the largest possible number of drivers are to benefit by having the most effective guide lines in place for the summer season.



SAN ANTONIO IS CATCHING UP ON OVERDUE WATER WORKS IMPROVEMENTS

R. A. THOMPSON, JR.
General Manager,
City Water Board,
San Antonio, Texas

A VAST improvement program highlighted by construction of three new electrically-operated primary pumping stations, new elevated and ground storage tanks and 130 miles of mains is nearing completion in San Antonio. The new stations are replacing, to a large degree, steam pumps 50 or more years old.

The improvements had been delayed because the indenture securing the revenue bonds, issued when the City of San Antonio purchased the water works in 1925, prohibited any additional bonds while any part

of the original issue was outstanding. As a result, the San Antonio water system for more than 30 years was compelled to make all improvements and expansion of the utility out of current income.

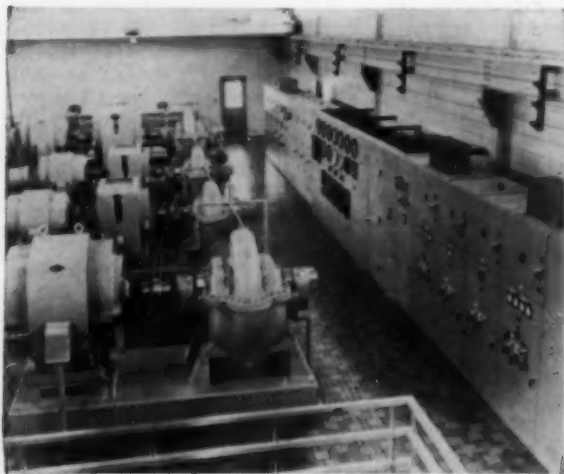
It was an era, in which the system's customers increased from 38,363 to 110,612. Population increased from 195,000 in 1925 to 531,000 in 1956. Water consumption in the period increased from 24 million to 74 million gallons daily. In 1959 the water system had 123,236 meters serving an estimated population of 550,000.

Finally, in 1956, the city refunded the outstanding bonds of 1925 and the people of San Antonio voted a \$20,885,000 revenue bond issue. Improvements to the distribution system got under way almost at once

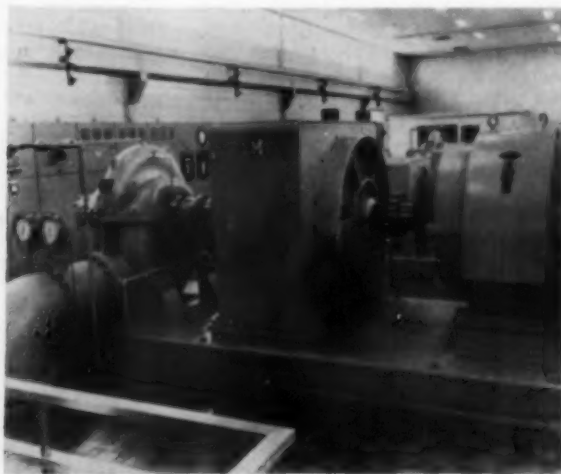
and now the program is in its final stages.

One of the new pumping stations is adjacent to the Market St. station that had been a landmark in the city since 1890. It is located in the heart of the downtown high value district. The station's two old 4-story steam pumps for years had fascinated passersby. Today residents are intrigued by the fact that the new station's four-electrically-driven pumps which replace the "slow-speed monsters" are only 5 feet high yet they have a combined rated capacity of 52-million gallons per day.

Automatic controls at the Market St. station maintain a steady pressure of 80 psi throughout the area served, with constant motor speeds. The station has an 800,000-gallon



● OLMOS BASIN pumping station with 60 mgd capacity has 4 high service pumps with variable speed magnetic couplings.



● ANOTHER view of 900 hp, 900 rpm pump with magnetic drive, one of the four pumps at the Olmos Basin station.

ground storage tank. The cost of this station was \$600,000.

San Antonio's only source of water at present is the Edwards Limestone formation. Engineering studies indicate that between 1963 and 1965 the city may find this source inadequate. Studies have been under way for some time to find a surface supply and, with that planning in mind, the present improvement program includes a few stations in the northern part of San Antonio, laid out with a view toward eventually picking up and distributing water that may come into the city from an outside source.

This new structure, called Basin station, is the largest of the three new pumping centers and cost \$1,700,000. It is located atop the city's flood control reservoir known as Olmos Basin. Four Edwards Limestone artesian wells are the Basin Station's present source of supply. The station has four high service pumps with a rated capacity of 60 million gallons per day. It is equipped with Electric Machinery synchronous motors and variable speed magnetic couplings, all controlled by EM switching gear. The station also has a 5-MG steel ground storage tank.

The city's third new major pumping station is located on the west side and is known as the 34th Street Station. This station draws from three wells and its four high service pumps have a combined capacity of 33 mgd. Prime movers are EM direct-connected synchronous motors that are controlled by EM switchgear. The station also has a 5-MG steel ground storage tank. Total cost was \$1,150,000.

San Antonio's process of "catching up" also contemplates improvements at five other pumping stations. These include another 5-MG ground storage tank; three new wells; two 11-MGD pumps; and two 6-MGD high service pumps. Cost for this additional work was \$840,000. In addition, the program includes construction of three 1.5-MG elevated storage tanks at a cost of \$270,000 each.

The old steam plant in Brackenridge Park was installed in 1915 and was recessed 44 feet in the ground. It became obsolete and too costly to maintain and is therefore being abandoned. (It required an operating staff of five men on an around-the-clock basis.)

The new electric plant being designed by Black and Veatch will be operated by remote control and maintained by a roving crew. It is being designed to produce 30 MGD,

6 MGD more than the old plant. Cost is estimated at \$725,000.

The City Water Board's three new 1.5-MG elevated storage tanks are of the radial-cone bottom type. They have a 35-foot depth range and are mounted on towers ranging in height from 80 to 110 feet. Erected under a single contract with Pittsburgh-Des Moines Steel Co., each cost \$270,000.

A total of 132 miles of distribution mains are to be installed under the City Water Board's current improvement program. They range in size from 36 inches down to 12 inches, with some 6 and 8-inch. An initial \$10,168,455 in bond funds has been allocated for main improvements of the system.

San Antonio has a unique problem throughout half the area served by the City Water Board. Electrochemical reactions with soil subjects pipe to deterioration. Because of the long-deferred replacement of corroded pipe, main breaks became

rather frequent. The problem was studied by Black and Veatch, who recommended replacement of a number of mains.

Procedures to prevent the situation recurring include encasement of cast iron pipe in silica sand, a minimum 6-inch thickness. The use of cement asbestos pipe where the concentration of salts is low; and, in limited areas, the use of cathodic protection are other preventive procedures.

With major improvements accomplished, San Antonio's City Water Board nevertheless is faced with still further "catching up" in its distribution system. To facilitate this continuing program studies are now being completed toward development of a master plan, including areas from 1½ to 2 miles beyond the present boundaries of the city. The city presently includes 172 square miles, with plans under study for extensive annexation.



● LARGE diameter main, part of the large scale improvement program, is protected by silica sand encasement because of severe soil conditions in portion of city.

Tracer for CIRCULATION and

JAMES H. CARPENTER

Chesapeake Bay Institute,
The Johns Hopkins University

RESearch at the Chesapeake Bay Institute of The Johns Hopkins University has led to the development of a sufficiently sensitive tracer material to allow direct experimental estimates of the time and space distribution of materials introduced into natural bodies of water. The movement of the tracer may serve to measure very feeble currents and provide an average value of speed over the path of movement. In addition to responding to the net movement of the water, the tracer material is affected also by the random movements which lead to turbulent dispersion. The development of theoretical models of turbulent diffusion has not been adequately supported by experimental observations on natural systems, since tracer techniques have been limited to small scale model or flume studies. Our purpose has been the development of methods which would be suitable for lakes, impoundments and estuarine systems.

The choice of a tracer material is based on the following features: 1) sensitivity and ease of quantitative detection; 2) resolution of the tracer material from naturally occurring substances; and 3) cost, ease of handling and hazard to man or aquatic life. Ease of analysis is particularly desirable, so that efficient sampling may be maintained by continuous observation of the distribution of the tracer in order that suitable modifications of the sampling program may be made to give a clear picture of distribution.

Rhodamine B, a commercial organic pigment is an excellent tracer material. It is non-toxic to human beings and fish can survive for two months in 100 mg/L solutions. It is quite soluble in water (2 percent by weight) and is available commercially in a 40 percent by weight solution in acetic acid (duPont de Nemours). It is highly soluble in methanol, so that concentrated solutions may be adjusted to the same density as that of the waters to be studied and density streaming avoided.

Rhodamine B is readily detected by its fluorescence. The adsorption

spectrum has a maximum at 550 millimicrons so that the molecule is readily excited to fluorescence by the green (546 millimicrons) line of mercury. The fluorescence spectrum of Rhodamine B has a maximum of 580 millimicrons and extends into the red portion of the spectrum. These characteristics are not found in the naturally occurring fluorescent substances which are excited

or space may be obtained by pumping samples through the instrument. The instrument is available in either manual balancing or servo balancing and recording versions.

The sensitivity of detection of Rhodamine B is 0.025 part per billion per fluorometer unit at 20° C. The instrument is readable and stable to plus or minus 0.5 fluorometer unit, so that the detection limit might be



● **FLUOROMETER** with flow cell permits continuous monitoring, with time and space records. Though suited for field work, the detection limits are as low as 0.05 ppb.

by light of shorter wavelengths and also emit light at shorter wavelengths. The green mercury line may be isolated by simple filters, so that the nearly monochromatic exciting light is readily removed from the emitted path. The long wavelength of the exciting light reduces the adsorption and scattering by the water.

Field Analysis

The Turner Model 110 Fluorometer (G. K. Turner Associates, Palo Alto, California) is readily adapted to field analyses of Rhodamine B concentration. The instrument is rugged and may be operated satisfactorily with portable gasoline generators with their poor frequency and voltage regulation. This instrument may be equipped with a continuous flow cuvette, so that continuous records in either time

taken as 0.05 part per billion. These specifications apply to the filter set up for highly turbid waters, for which the blank reading is not measurably different from that of distilled water. For clear water the sensitivity may be increased by a factor of two with suitable filters.

The fluorescence of Rhodamine B decreases with increasing temperature. The rate of decrease is 2.3 percent per degree C over the temperature range of 12 to 28°. This temperature coefficient is so large that for accurate determinations the temperature of samples should be monitored.

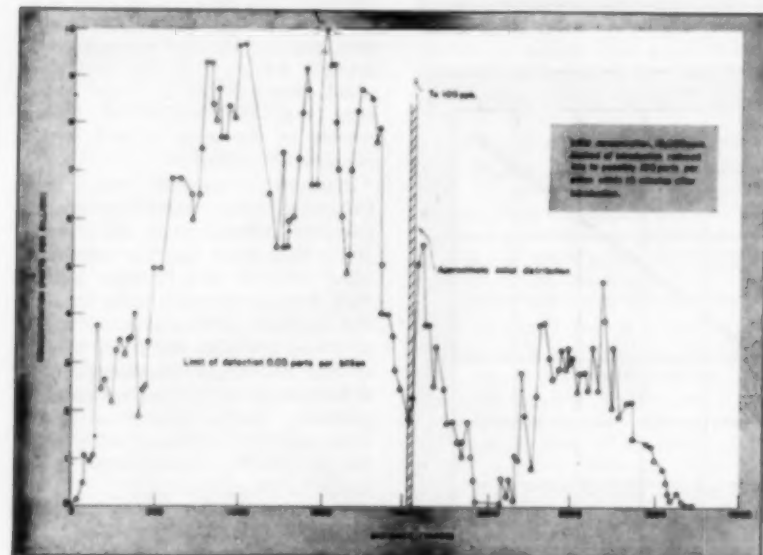
The fluorescence of Rhodamine B is not affected by the pH of the medium over the range 4.0 to 10.5 pH. Below pH 4 the fluorescence decreases. The material may be used in acid environments by suitable calibration, since the fluorescence is

MIXING IN NATURAL WATERS

decreased by only 13 percent at pH 2.

Aqueous solutions of Rhodamine B are reasonably light-fast. Storage in glass bottles on the laboratory bench with daylight fluorescent lighting for eight months resulted in decreased fluorescence of 5 percent. Exposure of solutions to direct sunlight in a south window for two months caused a decrease in fluo-

rescence of 40 percent. It appears that decomposition by light would be negligible for periods of up to two weeks in natural systems. The reasonable light fastness of Rhodamine B makes this material superior to disodium fluorescein which, in a 1 mg/L solution, is completely decomposed by 12 hours exposure to direct sunlight.



● CHART shows distribution of Rhodamine B in Baltimore Harbor 18 hours after its introduction. Six days later, it had spread laterally 1.5 mi. across the Harbor.

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Tracer studies in lakes and estuaries with Rhodamine B are less costly than with other techniques. The current price in solution is approximately \$5 per pound. The cost of tagging one million cubic feet of water with a detectable quantity of Rhodamine B (0.1 ppb) is three cents. Experiments involving 10 billion cubic feet (a rectangular volume 7 nautical miles by 1 nautical mile by 40 feet) required investment of approximately \$300. While this is not inexpensive, the

Use in Baltimore Harbor

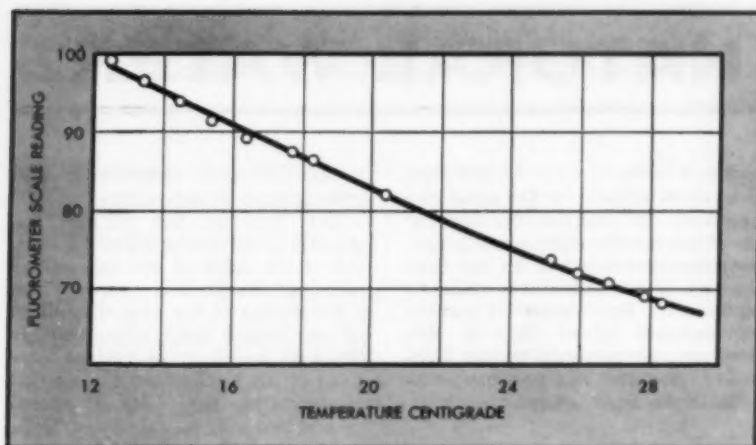
Rhodamine B has been used by the Chesapeake Bay Institute in their study of the exchange or flushing rate of Baltimore Harbor. The Baltimore Harbor region is utilized by several industries as a waste disposal area. At the present time some portions of the Harbor, mainly tributary bays and creeks, are seriously overloaded and undesirable levels of waste accumulation result in pollution. The purpose of the Institute study is the determination of the rate of exchange of several portions of the Harbor with each other and the rate of exchange of the Harbor waters with the adjacent region of the Chesapeake Bay. This rate of renewal of the Harbor waters determines the capacity of the Harbor to assimilate wastes and is, therefore, a fundamental parameter

in the sanitary engineering and management of the region.

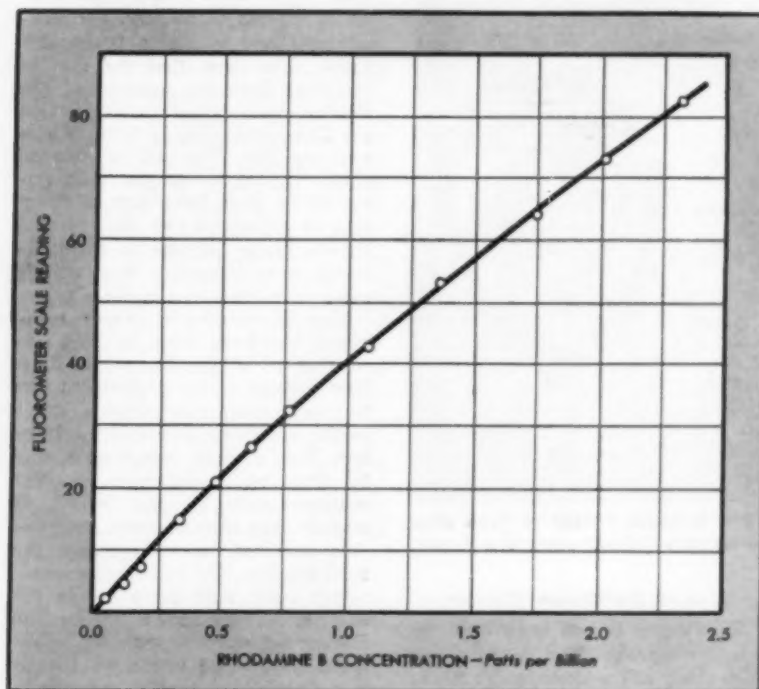
The Institute has utilized the waste acid accumulation in the Harbor as an index of the rate of renewal of the Harbor waters. From a knowledge of the rate of addition of acid (which totals approximately 500 tons per day) to various portions of the Harbor and the amount accumulated, the daily fractional rate of loss may be calculated. During the first 18 months of the study, 17 surveys of the Harbor have been made and over 6000 individual measurements of salinity, temperature, pH and alkalinity performed. These data show that the rate of exchange between sections of the Harbor and between the Harbor and the Chesapeake Bay is 10 to 20 percent per day. The rate of renewal of the Harbor waters by fresh water inflow from the Patapsco River is 1 to 2 percent per day, so that the exchange process is quantitatively more important in providing waste assimilative capacity.

The Rhodamine B tracer technique has been used in only one experiment in the Harbor to date. One purpose of the experiment was to measure the movement of water in the dredged channel of the Harbor. This area is inaccessible, due to ship traffic, to direct current measurements for the period of several days of continuous observation required to average out the tidal motion. The salinity measurements show that the water in the channel is freshened within the Harbor by mixture with the overlying less saline water, so that it was anticipated that a net movement from the Bay into the Harbor would result from this density gradient. The Rhodamine B was introduced into the channel at the entrance to the Harbor and followed during the next six days. The material, which remained in the channel, moved up into the Harbor with an average speed of approximately one mile per day, or about twice the rate of the fresh water inflow into the area.

During the course of the flow turbulent dispersion resulted in spreading of the material; at the end of 18 hours, it was spread over 4000 yards. Six days after release, it had spread laterally across the Harbor, approximately 1.5 miles, and



● FLUORESCENCE of Rhodamine B tracer decreases with increasing temperature.



● HIGH SENSITIVITY calibration chart for the Turner Model 110 fluorometer.

longitudinally along the axis of the Harbor over a distance of 6 miles. By the sixth day most of the material was spread almost uniformly with depth, in agreement with other evidence which indicates that the circulation pattern in Baltimore Harbor during some seasons of the year involves inflow in the lower layers, outflow in the surface layers, and extensive upwelling and vertical mixing in the inner Harbor.

This experiment is presented here as a field demonstration of the tracer technique. Laboratory experiments indicate that adsorption on suspended particles and living material in

the water from this region is not significant. A 0.42 ppb solution of Rhodamine B in a sample which contained a large algae population showed no decrease in fluorescence over four days in the laboratory. The field experiment does not give any indication that adsorption is significant but, due to the complex distribution, only 70 percent of the material was present in the area monitored during the first three days. The material has also been used in a power reservoir, where the distribution is less complicated, and a mass balance of over 80 percent was found for four days.

Water Treatment Plants Remove Radioactivity

Municipal water plants, though not designed for the purpose, can remove a substantial fraction of radioisotopes from water they process, studies at the Hanford atomic laboratories, Richland, Wash., indicate.

Robert L. Junkins, a senior General Electric engineer at Hanford, reported to the Nuclear Congress on a year's sampling of the Pasco municipal water system filter plant 39 miles below Hanford nuclear reactors. He explained that General Electric, which operates Hanford for the Atomic Energy Commission, conducts this sampling as part of an extensive environmental monitoring program in Hanford's vicinity to provide guidance in the control of plant operation practices and to assure that the release of atomic wastes in the area is well within recognized limits.

Hanford's reactors use some Columbia river water for cooling purposes. Effluent from the reactors when discharged into the river contains several radioisotopes generated during its quick pass through the reactors. Columbia river water at Pasco contains about 15 percent of the maximum concentration of radioisotopes permitted by national radiation health authorities. After treatment in the Pasco filter plant the permissible concentration is reduced to about 5 percent.

The plant's efficiency in removal of radioisotopes varies with the seasonal demand for water. It is least efficient during summer months when the water plant is operating near capacity and there is less time for radioactive decay as the water passes through the treatment plant. However, this corresponds with the highest flow rates of the Columbia river when the effluent from the reactors is diluted most by increased water from the mountain snow melt.

Some of the radioisotopes are removed by sedimentation and filtration. The solid wastes from these sources are periodically removed by flushing. Because of radioactive decay, there is little accumulation of radioisotopes in these solids or elsewhere in the plant.

• • •

Speed and Traffic Deaths

A study compiled by The Travelers Insurance Companies shows that speed was primarily responsible for 12,980 traffic deaths in 1959—more than 43 percent of the total.

Conduit Problems



ROBERT J. FLETCHER
Civil Engineer,
Cupertino, California

MANY COMMUNITIES that for years had no need for drains now have extensive storm drainage systems. As more land within or adjacent to these areas was built up, the run-off became larger. At the same time the areas into which this water could flow and dissipate harmlessly were reduced. Inevitably, flooding began to occur regularly and as population increased, required drainage work became more complex. Then came the need for a completely integrated drainage plan together with legal instrumentation and funds to carry it out. The situation is a typical and continuing one. As a guide to responsible engineers charged with such work, various design factors are discussed here.

Flush Inverts for Storm Drains

One basis for design for a continuous run of different-sized storm drains calls for the inverts instead of the crowns to be flush at each transition of pipe size. For example, assume that a drainage system under consideration is substantially straight, that all pipes are circular, and that no pipe is followed on the down-stream end by a smaller one. Then refer to the diagram of Figure 1. For clarity, this has been specially made up so that, although the total invert drop is $3\frac{1}{2}$ feet, the elevation of the crown at the lower end is identical with that at the upper end 3900 feet away. Gutter storm inlets and branch entering drains bring the total drainage areas up to the design quantities for each length as shown. The natural ground slope is small. If a flowing-full velocity of

2.5 fps is selected as a minimum, the pipe sizes shown are called for by the use of Manning's formula with "n" equal to 0.013.

One argument for keeping inverts flush is that drops at the bottom soon fill up with debris. However, the correctly designed drop in the manhole should be a gradual slope from the entering to the leaving pipe to prevent this problem.

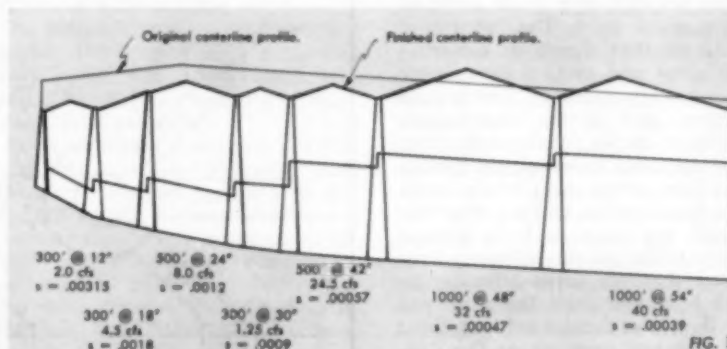
Another argument for the use of flush inverts is that it is best when the terrain is such that the available head is small. Additionally, the space at the top of the pipe may never be used anyway. For example, in Figure 1, with 40 cfs flowing out of the 54-inch diameter pipe the depth in the mouth will not be over 1.82 feet just as long as the level in the body of water into which it empties does not submerge the flow.

If the pipe should be submerged, the story is different. When the water at the mouth rises to the crown of the 54-inch diameter pipe and the system fills, there is no head at all from the beginning to the end of the 3900 feet and there is no flow until the upstream hydraulic grade

rises still further. If a minimum cover is used over the upstream lengths, not only will there be no flow at all when the pipes become just full, but the design flow can never be carried because of the impossible magnitude of the street flooding that would have to take place first.

A system built with crowns flush, but otherwise identical to the foregoing, will begin to operate under the exact conditions for which it was designed when all lines are full. The favorable flow conditions that exist when the mouth of a given section is not submerged are merely factors of safety. In addition, the crowns-flush system will carry quantities, within limits, above the design flow without creating back-up nuisance.

At the outfall, the crown of the crowns-flush drain would be $3\frac{1}{2}$ ft. below that of the Figure 1 system. If the water surface rose to the same absolute elevation over each system, the effects would be exactly the same. Thus, if a system empties into an artificial channel to be built by another authority, there is always



● **HYDRAULICS** for a storm drain constructed with inverts flush. In this example the crown at the upper end is at the same elevation as the crown at the lower end.

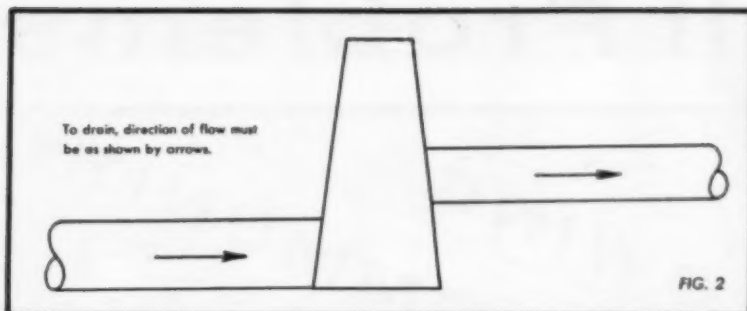


FIG. 2

● SITUATION to be avoided, since upstream flooding may necessitate pumping.

the chance that the design flow of the crowns-flush system will be limited.

Submerged Manhole Inlets

No drainage plan should be considered complete unless there is sufficient information to guarantee adequate drainage to the ultimate disposal point. If this information is not properly checked first, there is the risk of ending up with the furthest downstream manhole of the approved unit looking, in profile, like Figure 2. Once a situation deteriorates to such a state, the choice of what to do next may not be a happy one. Upstream flooding is likely to occur, or a pump may need to be installed. The latter solution introduces new problems and is a source of additional continuing expense to the community.

By flooding the downstream end of the system before any flow can occur, part of the safety factor inherent in the standard drain design has been nullified. Such a subdivision drain system is not able to deliver the full value that should be obtained from the money put into its construction.

Storm Inlet Capacities

An agency concerned with the design of drains may make a standard detail drawing of a catch basin or storm water inlet. The location of inlets are then shown on construction plans and profiles by suitable diagrammatic symbols. This is good practice and avoids unnecessary repetition of the details of the unit. In some cases, however, the symbol goes in at every point where water is to be picked up, and the structure, always the same, is built without regard to the quantity of water. Only if the drainage areas tributary to each inlet are about the same will the flow to each inlet get in without running past, ponding on the sidewalk or pouring into buildings.

Each inlet, based on its details of size, shape and pattern of openings,

has the ability to pass a certain quantity of flow for each different condition of head. Variations of the head on the openings depend on longitudinal and side slope of the gutter and on other details. Once the characteristics of the inlet are known, an experienced person can readily determine if the inlet can fulfill its function in a particular situation.

Catch Basins

Some jurisdictions regularly use the type of inlets shown in Figure 3a. The grates serve also as manhole covers, and the water drops directly upon the flow in the pipe below. This is a good method if the pipe runs along under the center line of a paved curbless alley with the pavement sloping from each side to the middle. Other communities use the pattern of Figure 3b, quite a usual one for center crowned streets with curbs and gutters.

All flows have to get energy before movement occurs. In structures of the type shown in Figure 3b, details may often be arranged so that

the kinetic energy of the entering flows will have the magnitude and the direction of the exiting flow. In inlets like those of Figure 3a, the flows that drop through each grate have a cumulative effect in raising the upstream water surface higher and higher. If the designer is not prepared to make a thorough analysis of hydraulic grade and energy lines throughout the drain system, there is a better chance of getting good results with a type "b" system, than with a type "a" design.

Although the peculiarities of the construction used in any area may not be covered completely, there is much useful information to be found in "Pressure Changes at Storm Drain Junctions" and "Design Methods" which make up Engineering Series Bulletin No. 41 of the Engineering Experiment Station of the University of Missouri.

In general, storm drains should parallel the surface slope. A terminal, or lowest, drain leaving a subdivision should not be tolerated at a down slope greater than the average surface slope, merely to save the subdivider a pipe size. If this is done, somebody downstream will have to pay for a larger pipe to get back to the proper grade.

Design Assumptions

The standard design method yields the design quantity that is likely to present itself at the head end of a drain. Then a pipe size and invert slope is selected to carry that design quantity. An assumption is often made that flow is "normal" or under "equilibrium conditions." This means that flow is treated as if the pipe were of infinite length, and the

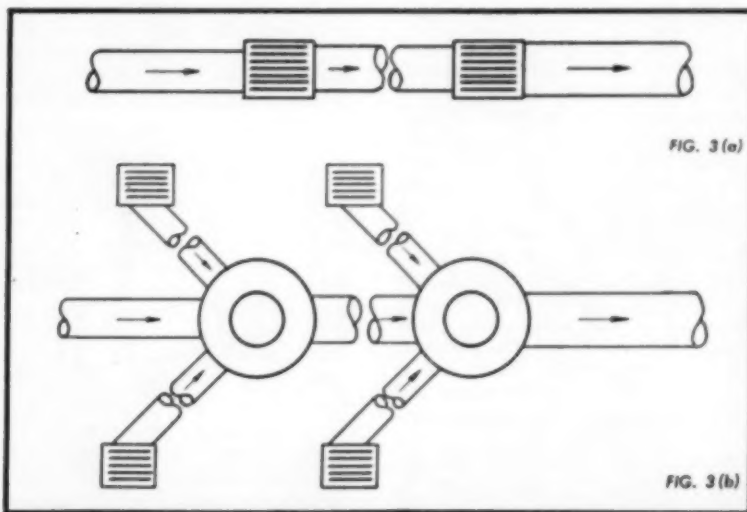


FIG. 3(a)

FIG. 3(b)

● TWO arrangements of street inlets. Effects on flow are discussed in the text.

part considered were in the middle. Actually, what happens at the entrance and at the exit of a pipe always influences flow conditions, sometimes very considerably.

The following are two specific examples of the type of end conditions that invalidate a design that does not allow for them: 1) If a pipe enters low into a deep ditch, and its crown is submerged by four feet of water therein, the flow in the pipe is not "normal" because there will be four feet less available head over some length of the pipe than "normal" flow assumes; 2) if a 30-inch diameter pipe is laid on an invert slope of 0.021, assuming "n" equals .013 in the Manning formula, its "normal" capacity is 60 cfs with a velocity of 12.0 fps. Unless the entering flow of 60 cfs already has this velocity directed along the axis of the pipe, the liquid level at the entrance will build up above the crown of the pipe until sufficient head is created to overcome entrance losses and produce the velocity. In this case the energy

of motion is almost 2.5 feet, so that the surcharge or drowning of the lower end of the next pipe up the line may be sizeable.

In a study of hydraulic grade and energy lines the question arises as to what flows will be used in each length. For example, if the five-year frequency maximum design quantity for one length is 20 cfs, and for the next length downstream is 30 cfs, there is nothing in the intensity-duration-rainfall curve (through the use of which these quantities were derived) to warrant assumption that the two flows occur at the same time. As a matter of fact, it might be that the upstream quantity, which had a smaller time of concentration, occurs first.

If significant storms on which to base a plot of similar curves are not known, then original rainfall records should be studied to obtain design flows for use in all lines at one time. Otherwise the quantities assumed to be flowing at the same time may not be correct, and the relative safety between parts of a

drain system designed in this way, and parts designed one length at a time becomes unknown.

Channel Problems

If drains terminate in an open unlined earth ditch or channel, mild bottom slopes will be needed in order to prevent erosion. Depth of downstream flow can be controlled by surfaces in other bodies of water, by restricting culverts or pipes under roads, or by critical depth flow at a drop. Care should be employed in using the "normal depth" for the design quantity when the excess available ground slope is used up by vertical concrete drop structures. The actual average velocity could easily be 50 percent and more greater than the normal velocity. In general the milder the invert slopes, using vertical drops, the greater will be the drop in level and in total energy content from the "normal" to the "critical" condition; and the greater will be the velocity increase. On mild slopes this drop

(Continued on page 196)

A STUDY OF GROUND WATER QUALITY AND CONTAMINATION SOURCES

A STUDY of the present extent of contamination of ground water in Suffolk County, Long Island, New York, has been made by H. W. Davids, Director of Environmental Sanitation, and John M. Flynn, Associate Public Health Engineer, of the Suffolk County Department of Health. The study, which also considered the future probable extent of ground water contamination, represents an excellent piece of work. Portions of the report are abstracted or quoted to illustrate methods of making the study and to describe conditions that were found. There are few sewers in Suffolk County and most wastes are discharged into the ground.

Contamination Sources

There are more than 600 industrial plants in Suffolk County. Visits to about 400 of these indicated that 30 of the plants were discharging treated or untreated wastes at the

time of the survey. An intensive study in the Town of Babylon covered 350 industrial establishments in 26 separate areas; of these, 11 were discharging industrial wastes, only two of which provided treatment; two other plants produced wastes of no immediate significance. The industrial wastes produced totaled 17,500 gpd and contained nitric acid, hexavalent chromium, cadmium, nickel, cyanide and synthetic detergents.

It is estimated that there are 150 laundries and laundromats discharging untreated wastes into the ground water. A check of 14 laundromats showed 179 machines using 4,010 lbs. of washing compounds per month (including detergents, but not alkalies, blueings and bleaches) and 500,000 gallons of water per month. Extending these results, it appears that laundromat use in the County is 5 MG of water and 40,000 lbs. of washing com-

pounds. Further, the wastes contain 250 mg/L of synthetic detergent on the assumption that 25 percent of the washing compound is composed of synthetic detergents.

It is estimated that 95 percent of the domestic and sanitary sewage in the county is discharged through subsurface leaching systems into the ground water. About 5 percent of the population is served by public sewers. The three principal sources of sewage are: An estimated 2 MGD discharged by institutions and industrial plants; some 20 MGD discharged by more than 100,000 private homes, not including additional substantial discharges for areas serving summer residents; and an indeterminate amount discharged by shopping centers and business areas. A cursory survey of several large shopping centers showed flows of 20,000 to 40,000 gpd.

There are scavenger disposal sites throughout the county where cess-

pool and other liquid wastes are discharged. Based on surveys of a part of the county, it is estimated that, for the county, the volume exceeds 100,000 gallons per day and with continued construction and subsequent failure of private disposal systems, this amount is constantly increasing.

Another source of ground water contamination as yet unevaluated is represented by the 19 garbage and refuse disposal sites scattered throughout the county. Based on the present population, the total refuse production is estimated at 450,000 tons per year. A part of this is incinerated; the bulk, however, is incorporated in raw form into a type of landfill.

There are more than 400 storm water recharge basins in the county, with an estimated daily volume of about 10 million gallons. While the importance of the recharge basin for water conservation and storm water disposal is unquestioned, the storm water flowing to these basins carries such materials as herbicides, insecticides and road surfacing material. No serious attempt has ever been made to evaluate the quality of the ground water downstream from recent recharge basins.

Evidences of Contamination

The Department becomes aware of ground water contamination usually only when tastes, odor or other characteristics are gross enough to cause complaints by users. A few specific instances are listed: Contamination of 16 domestic and 7 industrial wells by plating wastes which contained chromium, cadmium, zinc and synthetic detergents; of 25 domestic and 3 industrial wells by laundry and laundromat wastes; and of more than 600 domestic and 7 municipal wells by synthetic detergents. Also numerous chemical analyses of waters from domestic wells have indicated the presence of decomposing organic substances, sometimes in large amounts. Bacteriological analyses of water from domestic wells have shown coliform organisms in concentrations varying from an MPN of 2.2 to more than 2,400 per 100 ml.

The County Water Supply

About 70 percent of the population gets its water from some 90 communal or public water supply systems. There are several water bearing strata which, it is estimated, have a safe yield of 500 MGD and can serve about 3 million people. The three principal strata supplying water are: The Glacial, with pro-

ductive wells 50 to 100 ft. deep; the Magothy, requiring wells 300 to 700 ft. deep; and the Lloyd which is deepest and relatively unused. Most supplies are taken from the uppermost source. Few areas provide treatment and only about 10 percent of the water receives even token chlorination.

There are probably 50,000 individual wells in the County and most of them draw from the uppermost part of the Glacial stratum. In some parts of the County, building lots are 4,000 to 7,500 sq. ft. in area and sewage disposal systems for the homes are located on the same lot. Treatment is, of course, practically

representing probably 75 percent of the number of homes constructed. Both the septic tank with leaching field and the multiple unit cesspool are used, as are some special systems. These are developed by hydraulic fills and necessitate digging to underlying sand and gravel through mulch, clay or hardpan to depths of 10 to 50 ft. Experience with these has been limited; they have functioned to date but the period of experience with them has been insufficient to form a final judgment. They also appear to be extremely expensive and, in case of failure, to present very difficult problems of repair or replacement.



● SHOWN at the meeting of the Suffolk Co. Chapter NYSPE at which this article was presented are (left to right) H. W. Davids, John Blydenburgh and John M. Flynn.

negligible and a laboratory control system would be impracticable.

Sewage Disposal

There are eight communities in the County having public sewerage systems. The existing treatment plants have a total capacity for approximately 37,000 persons. The 95 percent of the population relying on individual installations are fortunate in that, over most of the county, soil conditions are such that the private systems can dispose of the sewage with a minimum of maintenance problems. A factor in this has been the sound construction standard prepared by the Department. However, this is not a measure of the necessity for public sewers since there are substantial areas where there is an urgent need to replace failing and overloaded private installations, many of which have been in service for years.

The number of disposal systems inspected annually by the Department averages 6,500 per year, rep-

Criteria have been prepared outlining minimum standards for water supply sources for subdivisions, including those that apply to individual systems. The most significant item is the minimum plot area of 20,000 sq. ft.

Syndet Problems

Sampling, carried out as a result of complaints, has indicated synthetic detergents to be present in over 600 domestic wells tested. Surveys in 11 areas have shown syndets present in as low as 8 percent to as high as 95 percent of the wells sampled. It should be noted that not all wells in the area studied were sampled. Due to limitations of manpower and laboratory facilities it has been necessary to resort to spot-checking.

The wells found to contain syndet averaged 35 percent. If this percentage were applied to the estimated 50,000 wells in Suffolk County, it is possible that some 17,000 wells contain syndets or will be

affected by them in the near future.

Complaints relative to the physical quality of the water (taste, odor, foaming) do not usually occur until the syndet content exceeds 1.5 mg/L.

Complete chemical analyses of samples containing syndets consistently show large concentrations of the chemical constituents normally associated with sewage. This is not remarkable in that we know syndets originate in the sewer system and consequently should be present with all other normal constituents of sewage. One significant factor is the large amount of free ammonia, indicating in many cases the freshness of the sewage and

1958, survey was 0.5 to 1.5 mg/L, and of the total, 2 samples were over 1.5 mg/L; the range for the November, 1959, survey was 0.5 to 4.5 mg/L, and of the total, 13 were over 1.5 mg/L, 7 of them over 2.0 mg/L; six of the samples collected in November, 1959, showed the MPN per 100 ml of coliform organisms from 2.2 to greater than 240.

In the October, 1958, survey there were no samples collected for coliform analysis. The department has in recent investigations commenced to correlate bacteriological results with the presence of synthetic detergents and the other sewage constituents identified in contaminated wells. Six samples positive for coli-

maintained below the taste or foaming levels.

Needed Research

A review of applicable research indicates a need for new and additional knowledge in the following areas: The effect of existing private sewage disposal methods on wastes prior to their discharge into the ground water.

Sewage discharged from a sub-surface leaching system must pass through varying depths of sand and gravel and other soils prior to their entering the ground water. It would appear that the length of travel, the time of passage and the nature of the soil would have some effect upon the chemical constituents and the biota including virus and bacteria prior to their entering the ground waters.

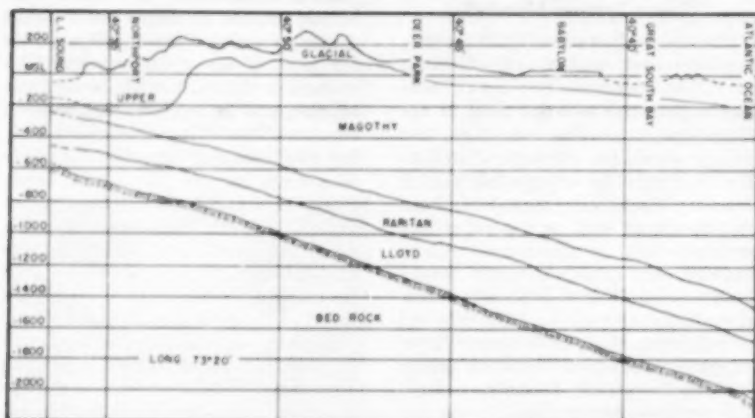
Wastes traveling through the soil above the ground waters are in a medium in which some biological activity may be assumed to take place. Once the wastes enter the ground waters the medium changes. We need accurate and reliable knowledge relative to effect of travel in the ground waters on soluble chemical wastes, bacteria and virus.

We need to explore the extent to which our ground waters may safely contain the bacteriological contaminants of sewage such as bacteria and viral organisms.

Preliminary investigation indicates that synthetic detergents inhibit the growth of coliform organisms. The effect of this on the coliform test, the present day accepted index of pollution, needs detailed evaluation.

It has been observed that very definite chemical changes occur as the ground water percolates from the Glacial into the Magothy strata. It has been assumed that these changes occur because of the ion exchange or the adsorption properties of the Magothy sands and/or the overlying clay lenses through which the water must pass. The belief is held that this constitutes a natural protective barrier assuring us of an uncontaminated supply in the Magothy strata. We need to know more accurately to what extent we may rely upon this so-called natural protection, since, certainly, this natural "purification" can not be replenished if it is ever exhausted.

The report closes with a series of recommendations on public sewerage, private disposal, public and private water supply, wastes other than sewerage and research.



● CROSS section of soil formation through Suffolk County shows the three water-bearing strata. Left margin indicates elevations in feet in relation to mean sea level.

close proximity of the point of discharge.

The synthetic detergent problem is one which becomes more severe with the passage of time. There is reason to believe that the syndets in the outset are slow in appearing in a contaminated well, but having once accomplished a break through, they seem to accumulate very rapidly.

The Department investigated the change in syndet level in a group of wells after a period of one year. In October, 1958, 41 of 54 wells sampled in North Lindenhurst were found to contain synthetic detergents. In November, 1959, samples were collected from 34 of the 41 wells which contained syndets in the original survey. The samples were analyzed for synthetic detergents and coliform organisms. The results of the November, 1959, survey indicated the following information. Two were equal in syndet content to the previous year's results; two had decreased; 30 had increased in syndet content; the initial syndet range in the October,

forms in a group of 34 wells is an unusually high incidence and indicates the wells studied to have been poor from a sanitary standpoint. There is reason to believe that the coliform occurrence might even be greater, but is masked by the presence of syndets. This belief is based upon a study by Dr. B. Newman of the Newing Laboratories in which it appears that in the presence of synthetic detergents the growth of coliform organisms is inhibited. The significance is that a false sense of security is created, since the test organisms on which we have relied so heavily as an index of contamination behave abnormally in the presence of syndets.

Syndets have been detected in at least 7 wells in three public water supply systems. In all instances the wells are shallow, Glacial wells. The concentrations of syndets in the wells have varied from 0.3 to 1.2 mg/L. To date no complaints have been received from consumers in these water supply systems. This is probably due to the fact that the concentrations thus far have re-

PLANNED UTILITY PROGRAM ATTRACTS NEW INDUSTRY

F. G. GOFF

Administrative Assistant,
Orr-Schelen, Inc.,
Consulting Engineers,
Minneapolis, Minnesota

MANY SUBURBAN areas have been forced to solve their public works problems with a minimum of funds and personnel due to a low overburdened tax base. Property owners heavily taxed by county and state units find it difficult to pay for such utilities as sanitary and storm sewers, water, streets and curbs and gutters. To overcome this problem a few communities have planned an orderly growth system to assure a favorable balance between residential, industrial and commercial development.

The Village of Golden Valley, Minn., five miles from Minneapolis, started early to assure the development of a sound tax base. With a present population of 11,000 there is a potential development to 34,000 persons. The village covers an area of 10.7 square miles of rolling terrain. Home values range from \$16,000 to \$25,000 and upward.

One asset of Golden Valley is the excellent network of U. S., state and county highways, and railroads that provide an excellent transportation system. The suburb is served by U. S. Highway No. 12, State Highway No. 100 and State Highway No. 55; of equal importance are three railroads. These excellent transportation facilities placed the suburb in an enviable position in attracting industry and commerce. Rating with transportation in importance was the availability of a sanitary sewer and a water distribution system, a sound tax base and responsible government operation.

The village realized early in 1952 that the development of a sound tax base required the even balancing of residential, commercial and industrial planning. With this a restrictive building requirement was adopted supported by sound municipal ordinances and a far-sighted planning program. The major problem was the need to develop a mas-

ter plan for sanitary sewer, storm sewer and water in conjunction with a comprehensive master plan of the village to entice sound and civic minded industry and commerce to the village to share the increased tax burden.

Sewer System Needed

The council realized that an immediate need existed to develop an overall master sanitary plan. Of similar importance was the need to assure that, following sewerage, the village would have a water distribution system. The village felt that if industry could be assured of these two items, as well as a good school system, park program and village development plan, industry would be attracted. With this plan in mind, the village council in 1952 selected Orr-Schelen, Inc., of Minneapolis to prepare a preliminary survey for an interceptor system, including a master sanitary sewer plan.

The first step taken was to apply to the City of Minneapolis for permission for Golden Valley to join the Minneapolis-St. Paul Sanitary Sewer District, so that it would not be necessary to build a sewage disposal plant. The sewer project, under the direction of Robert A. Huston, former Minneapolis Sewer Engineer, progressed rapidly and in February, 1953, the preliminary report was completed and the report made to the village council, with the following recommendations:

- 1) The system to be composed of three trunk systems.
- 2) The sewer system to be a gravity type with possibly one lift station.
- 3) The design to be based on Minnesota State Board of Health standards of 250 gallons per capita, with an estimated sewage volume of 23 cfs based on 5,300 sewered acres assuming 10 persons per acre.
- 4) The village to be divided into trunk and lateral districts, as desired by council.

The report was accepted and Orr-Schelen, Inc., was ordered to prepare a sewer district map of the village. Following this each district was to be given an opportunity to

vote whether or not it wanted a trunk sanitary system installed. This policy was followed thereafter for each trunk or lateral district as the need for sewerage developed.

The preliminary plans for the South Trunk Sewer in the Tyrol Hills area indicated that the neighboring suburb, St. Louis Park, might desire to use this trunk as an outlet for part of its sewer system. The council contacted the St. Louis Park officials and an agreement was soon reached. The Village of Golden Valley was to supply an outlet for 10 cfs of sewage for the City of St. Louis Park in its system in return for which St. Louis Park would pay the additional cost of oversizing and maintenance. A sewer charge would be paid to Golden Valley on a metered basis arranged by contract.

With the development of the trunk system the village council began the important work of surveying the industrial and commercial fields with the goal of selecting favorable tenants for the village. It would be these tenants who would permit establishment of a sound tax base with a minimum of burden on the home owner.

The Northeast Trunk Sewer was ordered built in March, 1955, and was completed in January, 1956, at a cost of \$632,712. This project included the construction of the parallel line outlet in Minneapolis at a cost of \$144,600. A total of 22,000 lf of sewer was constructed on the project in Golden Valley. The field construction activities of this and subsequent projects in Golden Valley were under the able direction of A. G. Barnacle.

The construction of this trunk sewer resulted in the immediate petition and demand for lateral sanitary sewers to serve the area. Orr-Schelen was authorized to prepare a preliminary report for a public hearing. The public hearing indicated that an urgent need for laterals in the area existed; therefore, the council took immediate action and ordered preparation of plans and specifications for laterals.

The Northeast Lateral Sewer Project was begun in April, 1955,

and completed in January, 1956, at a cost of \$1,246,138 with a total of 132,884 lf of sanitary laterals constructed. The construction of the South Tyrol Trunk and the laterals for this area followed closely upon construction of the Northeast Laterals. The South Tyrol Trunk Sewer was completed in May, 1957, at a cost of \$988,025. The South Tyrol Laterals were constructed at a cost of \$964,441. The total trunk and lateral sewers constructed amounted to 123,500 lf.

The development of plans and specifications for the Northwest Trunk and Lateral Sewer represents the final step in completing the sanitary sewer system in Golden Valley. The trunk sewers were completed in November, 1957, at a total cost of \$1,556,160. The total trunk sanitary sewer constructed was 29,300 lf. The lateral sanitary sewer is not as yet complete, since part of the area has not been fully developed for building sites. As of the end of 1959, ap-



● DEEP manhole construction shown above; house services shown at right.

proximately 150,000 lf of laterals were built in this area.

The near completion of the Northwest Trunk System provided the final deciding factor in the decision of General Mills, Inc., and Minneapolis-Honeywell Co. to establish their base of operations in Golden Valley. The suburb was fortunate to have the facilities and physical potential necessary to attract these nationally recognized concerns as residents and taxpayers. The contemplation of, or completion of sanitary sewers closely coincided with the location of the following additional firms in Golden Valley: Minneapolis Gas Company; International Paper Company; General Motors Training School; Federal Container Company; G. H. Tennant Company; Upjohn Company; and Pako Corp.

These are but a few of the industries that have located in the village. There are at least ten national enterprises and numerous others less famous, but equally desirable.

The final question to be answered by those who believed that industry would aid their tax base and that sanitary sewers and prospects of a water distribution system would induce industry to locate in Golden Valley was: "Did this program result in a sound and substantial tax base that would be an aid to lessening the burden of the home owner?"

The answer to this question was adequately given by Robert Burns, the village assessor, in his report to the council in July, 1959. The total assessed valuation in 1955 was \$5,537,477. By the end of the fiscal year 1957, this figure had increased to \$12,060,695. This means that in 1960 each mill levied would bring in \$12,060. Of this figure \$5,920,260 are in the industrial, commercial and utility classifications.

The assessed valuation of the village has more than doubled in the past five years. The total valuation in non-residential classifications since 1955 has increased by 700 percent. In 1955, industry and commerce shared only 9 percent of the tax load as against the present 49.08 percent. Utilities in the village pay 8.82 percent of the tax load. Only 13 percent of the taxes collected go to village operation expense; the state and county take 25 percent while 62 percent goes to support the three school districts in the village.

The belief that a promise of utilities must precede efforts to induce

good industry and commerce was adequately answered by the final result. Very few villages can boast of a tax base shared almost 50 percent by industry and commerce. The financial structure of the village is soundly based and community standards were maintained and even raised to higher levels.

The administration of the government is in the hands of Roger Ulstad. The engineering functions are under the direction of Donald Sorensen.

A plan that can lessen the taxes of already overburdened residential property owners is directly related to development of a sound, equitable tax structure. The plan of Golden Valley to use industry to provide this relief is one example of how this can be accomplished. It is essential to develop a sound program of planning, ordinances, and public utility development to encourage good industry and commerce to locate in a city, suburb or village. Industry cannot afford to invest heavily in temporary utilities in the highly competitive business world of today. It must choose wisely where to locate its base of operations. The village that can offer good schools, parks, responsible government and public utilities will have first choice of the best industry and commerce. One of the major financial inducements to get industry to locate in Golden Valley proved to be a sanitary sewer system. To complete its program of expansion the village is contemplating installation of a water distribution system already designed for them by Orr-Schelen, Inc.

● AS A RESULT of utility program non-residential valuations are now 49% of total.



SOFTENING and IRON REMOVAL PLANT DESIGNED FOR LOW COST OPERATION

EDWARD B. SCHREINER
Superintendent of Water,
Pella, Iowa

FOLLOWING a decision to construct a plant for water conditioning, to involve both iron removal and softening, the City Council of Pella, Iowa, in 1957 employed Henry E. Cook, Consulting Engineer of Ottumwa, Iowa, to evaluate current practices and to recommend a design. Preliminary investigation work included consultation with representatives of the State Board of Health and visits by Mr. Cook and the author to several lime-soda and zeolite softening plants. It was felt that the operation and maintenance costs of these plants were excessive and that the design for Pella should endeavor to economize on these factors. This meant that automatic devices should be employed and the design should minimize pumping. Another design goal was to have the plant exterior resemble a ranch type residence.

It was decided to provide iron removal by aeration and filtration, and softening by the zeolite process, with pH control by means of anhydrous ammonia. Technical ad-

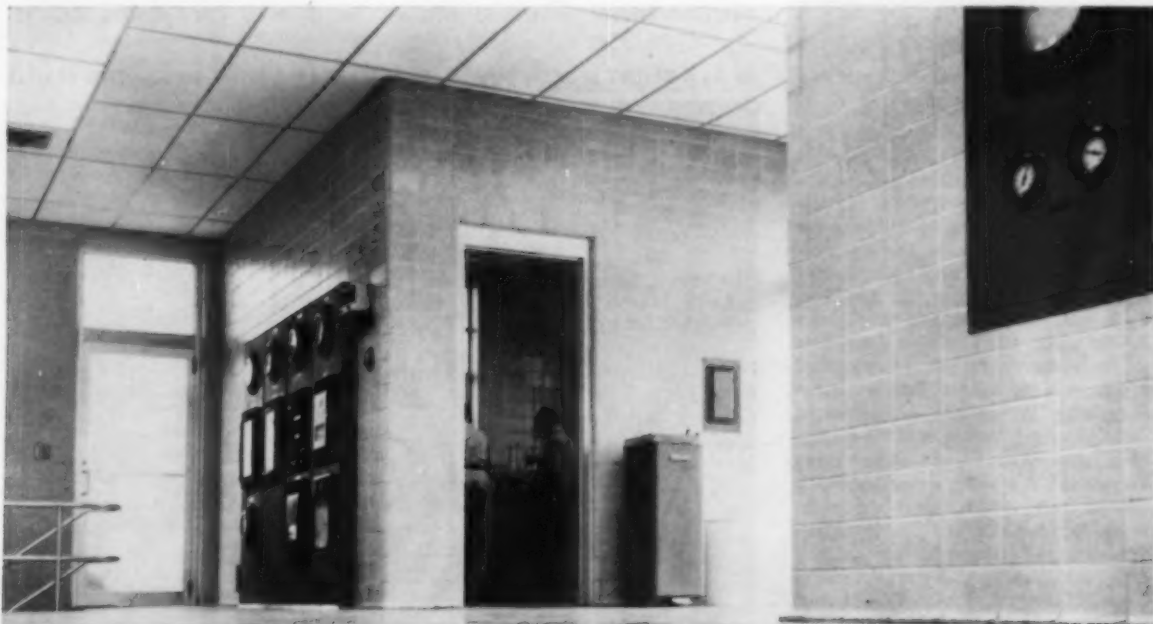
vice was obtained from the General Filter Co., the Permutit Co. and Culligan Zeolite, primarily for the purpose of anticipating friction losses through rapid sand filters and zeolite beds. Phillips Petroleum Co. was consulted with reference to the use of anhydrous ammonia.

To provide gravity flow and to have the housing structure look like a residence, elevations were critical. The total fall from influent to discharge had to be about 24 ft. The raw water is pumped from the Des Moines River and receives pre-chlorination at the pumping station as the first iron removal step. The design called for a flow sequence through a forced draft aerator, rapid sand filters and zeolite softeners to a 4-MG reservoir. Arrangements were to be made for blending of filter and softener effluents for maintaining a constant predetermined hardness level. The final effluent was to be pH-corrected, fluoridated and chlorinated.

Details of Design

By locating the aerator in the gable of the housing structure with exhaust discharge to the chimney, an influent elevation of 99.83 was achieved. The forced draft aerator,

furnished by General Filter Co., has dimensions of 6 x 8 x 7 ft. There are three rapid sand filter shells of concrete each 8 ft. by 14 ft. in cross section and 12 ft. deep. The containing structures of three zeolite beds are 8½ ft. by 8 ft. 2 in. and 12 ft. 4 in. deep. Inflow to the filters is over adjustable weirs set at elevation 91.58. The overflow level of the filters is 91.5. The filter effluent passes to a flow-splitting box. Flow is controlled at this point by precisely set weirs to divert a portion directly to the discharge line, thus controlling effluent hardness at 4 to 6 gpg. The influent weirs of the softeners are set at 83.08 and the final effluent line reaches a minimum elevation of 75.66, a distance of 200 ft. from the plant. The plant can operate on a minimum head loss of 15 ft., allowing a 9-ft. variation. The softeners are equipped with Nalcite cation exchange resin furnished by National Aluminate Corp. The resin beds are 4 ft. deep. Regeneration is by brine solution. Two salt bins of the "Lixate" type are provided, each designed to hold a carload of salt. Located underground, the bins can be loaded directly from a truck. Brine is delivered to the softeners by injector.



● INTERIOR, showing laboratory. Fluorescent lights, terrazzo floors and glazed tile walls contribute to appearance.

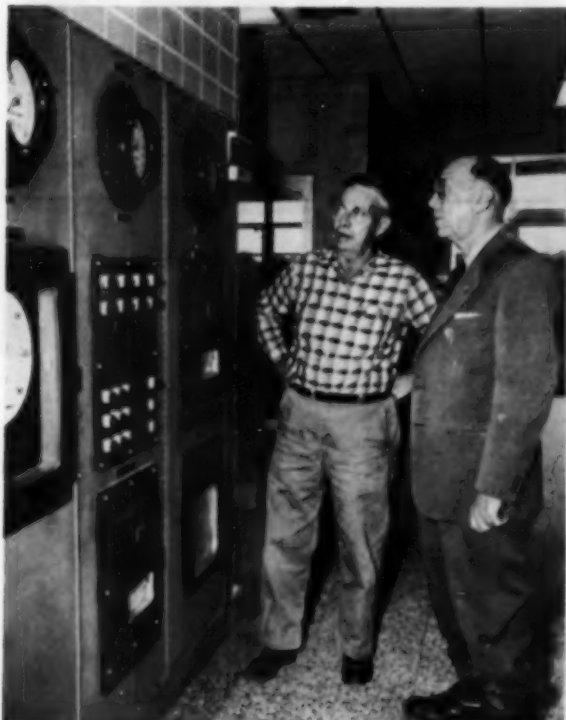
The chlorinator is housed in a separate room with entrance on the outside only. The room is separately ventilated and a "picture" window is provided to permit viewing the apparatus from inside the building.

In the laboratory we have a hood, electric oven, muffle furnace, refrigerator, analytical balance and other equipment right down to a first aid kit mounted on the wall.

Piping is of welded steel except for the brine solution where plastic

to service. The softeners are controlled by a hardness alarm furnished by the Hach Chemical Co. By clock operation, the output of each of the three softeners is analyzed at a preset time. When a predetermined hardness is attained, the softener operation is halted and the regeneration cycle is started. The analyzer also determines when regeneration is complete and effects return to service. An electrical interlock prevents the backwash of more than one filter or the regenera-

employees. This board records and transmits all information on operation of the plant to the power plant and water superintendent's office. Reservoir pumping is controlled at the power plant and river pumping at the treatment plant. An intercom system is designed to link the river pump house, treatment plant, power plant and the water superintendent's office. This was also designed and installed by city employees. There is even a control on the plant lighting to allow the lights to be turned



● MASTER switch and general control panel records and transmits all plant information. Author left, Mr. Cook right.



● PLANT provides for iron removal, softening and pH control, with gravity flow throughout. All pipes are welded.

is used and for control piping with copper tubing employed. Door and windows are aluminum-framed Thermopane. Recessed fluorescent lighting, terrazzo floors and structure glazed wall tile contribute to an attractive interior.

Instrumentation

The plant can be started from shut down on automatic, but is operated at a constant low flow of about 250 gpm. The filters are controlled through head variation and by an electric clock for triggering backwashing from the high service line. Operational valves are hydraulic cylinder Iowa double gate valves. Pneumatic transmission is used for control of filter backwashing, brining, rinsing and returning

tion of more than one softener at a time.

Fluoridation, chlorination and pH control are also subjected to automatic analysis, recording and correction. Flow meters for this control function were furnished by Hersey-Sparling and recorders by Bristol; the ammoniator and chlorinator by Wallace and Tiernan; and the sampler and analyzers by Hach Chemical Co. All metering is arranged for "fail safe" control.

The control board for filter and softener operation was designed by General Filter Co., with pneumatic transmission. The control board for chemical addition was made by Hach Chemical Co. The master switch and general control panel was designed and wired by city

employees. This board records and transmits all information on operation of the plant to the power plant and water superintendent's office.

Operation

The staff required for operation consists of a chemist for a half-day of each 24 hours and two men one hour per day. The plant was placed in operation in September, 1959 and performance has exceeded expectations. The plant has been operated at flows from 70 to 1200 gpm, but a constant outflow is maintained most of the time. The effluent has a hardness of about 4 gpg, iron content of 0.01 mg/L and pH 7.8.

Construction of the building was contracted to Roth and Associates of Storm Lake, Iowa; installation of piping, filters, and softeners to General Filter Co.



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NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Hurst Appointed Chairman Of International Relations Committee

Chicago, Ill.—William D. Hurst, city engineer, Winnipeg, Manitoba, Canada, has just been appointed



William D. Hurst

chairman of the American Public Works Association's newly formed Committee on International Relations.

Because of increasing contacts between the Association and persons from other parts of the world, the Committee has been established to coordinate APWA activities on matters dealing with international affairs and assist in the development of effective means of exchanging information on public works activities with officials of other countries. The Association, founded in 1894, presently has a membership of approximately 5,000 public works

officials with members in thirteen foreign countries.

Hurst, a former president of the Association, is a registered architect and civil engineer in Manitoba, and a former director of the American Water Works Association. In addition to his position as city engineer in Winnipeg, he is also commissioner of the Winnipeg-St. Boniface Harbor Commission and was chairman of the River and Streams Authority from 1952 to 1959.

Other members of the Committee are: Dr. Donald C. Stone, dean, School of Public & International Affairs, University of Pittsburgh; Verne A. Parker, director of public works, San Diego, Calif.; Frederick F. Aldridge, chief sanitary engineer, Division of International Health, U. S. Public Health Service, Washington, D. C.; Robert B. Brooks, consulting engineer, St. Louis Mo.; Paul R. Screvane, commissioner, Department of Sanitation, New York City; Harold J. McKeever, editor-in-chief, Gillette Publishing Company, Chicago, Ill.; Myron D. Calkins, city engineer, Department of Public Works, Tacoma, Wash.; Edward J. Cleary, executive director & chief engineer, Ohio River Valley Water Sanitation Commission, Cincinnati, Ohio; and Ernest A. Fort, director, Public Service Department, Miami, Fla.

Roy Morse Becomes Member of APWA Board

Chicago, Ill.—The American Public Works Association's Board of

Directors recently selected Roy W. Morse, city engineer, Seattle, Wash., to serve the unexpired term of former Board member William A. Bowes, commissioner of public works, Portland, Oregon. The decision of the Board was unanimous.

Bowes found it necessary to re-



Roy W. Morse

sign because of an increasing number of pressing commitments. He served as APWA's Director from 1946 to 1948 and was elected again in 1958 to serve until 1961.

Morse was general chairman of the 1959 Public Works Congress and Equipment Show held in Seattle, and is a past president of the Washington Chapter. He was formerly employed by the Boeing Aircraft company and held a federal position with the Department of Interior. He also served as Superintendent of Seattle's Water Department, and was named city engineer by Mayor

OFFICERS: Jean L. Vincenz, San Diego, Calif., *President*; Frederick W. Crane, Buffalo, N. Y., *Vice President*. REGIONAL DIRECTORS: (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Texas; (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; Roy W. Morse, Seattle, Wash., (term ending 1962) Paul R. Screvane, New York, N. Y.; Albert G. Wyler, New Orleans, La.; Edward J. Booth, Bismarck, N. D. *Immediate Past President*, Wm. D. Hurst, Winnipeg, Manitoba. Robert D. Bugher, Exec. Director.

Gordon Clinton and designated by him to head the city's board of public works, which must approve all contracts for public works construction. Morse's term on the Board will expire in 1961.

Plans Are Taking Shape For N. Y. Public Works Congress and Equipment Show

Chicago, Ill.—Almost all of the exhibit space for the 1960 Public Works Congress and Equipment Show to be held in New York City August 14-17 has been taken. Over 115 firms have already contracted for exhibit area which will make the upcoming show the largest ever sponsored by the Association and one of the most diversified.

Technical sessions are being scheduled for Monday afternoon, Tuesday afternoon and for all day Wednesday. The latest research and thinking will be incorporated into the numerous talks and panel discussions on a wide variety of topics. Among those scheduled on the preliminary program are: "Gains and Gaps in Water Pollution Control", "Transportation — The Key to Urban Development", "Snow Removal and Ice Control", "Proper Planting



The Coliseum in New York City, site of the 1960 Congress and Equipment Show.

and Care of Street Trees", "Flood Plain Zoning", "Sewage Treatment Trends and Developments", "Composting — Theory vs. Practice", "Placement of Utilities in Urban Communities", "Legal Aspects of

Public Works", "Automation: Basic Principles and Procedures".

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February 4, 1960

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Mr. Porini, Superintendent

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Hauling time is reduced two-thirds, this results in a large saving in gasoline, parts and labor. I would never again be without one.

Respectfully,

Weldon S. Campbell
Weldon S. Campbell
Tree Warden & Bush Supt.
Greenfield, Mass.

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That's the "reason why" successful men like Weldon Campbell prefer Fitchburg for the tough brush removal jobs.

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FITCHBURG ENGINEERING CORPORATION FITCHBURG, MASS.



"Our Fitchburg Chipper has been inexpensive to maintain and trouble-free in operation, and has meant a great saving to us in time and labor."
—F. A. Canose & Sons, Inc.
Philadelphia, Pennsylvania



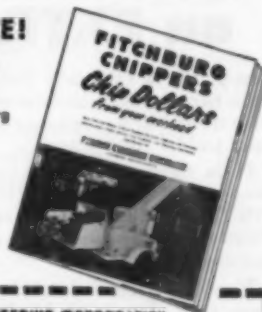
"During about 2,000 operating hours we have suffered neither employee accident due to chipper operation, nor major mechanical failure."
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"The Fitchburg Chipper is well constructed. The machine is trouble-free and easily maintained."
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Tewahship of Mahwah, New Jersey

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Position.....
Company.....
City or Town..... State.....

Jersey Chapter of APWA a personalized portfolio with his name imprinted on it in gold. An equally attractive portfolio will be presented to the ladies. A gold covered notebook with a ball point pen will be given advance registrants through the courtesy of the New York City Local Committee. In addition, limited to APWA members registering in advance, there will be a special drawing for a grand prize—an automobile (approximate price \$3,500).

Three post Congress tours are being planned. Alternate tours are being arranged to Europe which

will hit such historic cities as London, Amsterdam, Brussels, Paris, Geneva, Copenhagen, Frankfurt, Nice, and Rome. A ten-day Caribbean holiday will include a visit to St. John Island and a visit to the home of Don Herrick, retired executive director of APWA. The first stop from New York will be San Juan and then on to St. Thomas in the Virgin Islands. From St. Thomas the tour will go by boat to St. John with a cruise around the island's north shore taking in such sights as beaches, the ruins of sugar estates, Caneel Bay Plantation

(Laurance Rockefeller's tropical resort) Turtle Bay, Hawk's Nest Bay and other extraordinary sights. Following the return to St. Thomas Island the tour will continue to Haiti for sight seeing and evening entertainment and then on to Jamaica for another three days. Complete itineraries may be had by writing to the American Public Works Association, 1313 East 60th St., Chicago 37, Illinois.

Illinois Chapter Holds Organizational Meeting

Bloomington, Ill.—One of APWA's newest chapters, the Illinois Chapter, held an organizational meeting at Bloomington, Ill., April 20th. This is the second chapter to be formed in the State of Illinois, the first being the Chicago Metropolitan Chapter. The new Chapter takes in that area exclusive of the Metropolitan district.

Officers for the new Chapter include: Fred Penning, director of public works, Wood River, president; Lane H. Mashaw, city engineer, Rockford, vice-president; and James P. Murphy, consulting engineer, Crawford, Murphy and Tilly, Springfield, secretary-treasurer.

Directors elected for two-year terms are: Charles A. Nelson, city engineer, Springfield, and John T. Kearnes, director of public works, Champaign; elected for one-year terms are: Harley R. Greene, superintendent of public works, Bloomington, and Leonard H. Caro, director of streets and sewers, Peoria.

APWA President Jean L. Vincenz, one of the featured speakers, emphasized the need for public works officials continually to improve themselves and the quality of their work to meet the growing demands of the public. He pointed out benefits to be derived from chapter activities and complimented those responsible for organizing the new chapter. Robert D. Bugher, the Association's Executive Director, described various activities that have been carried out by other chapters and explained some of the services the national Association provides.

Another new chapter is being formed in Florida, which will bring APWA chapters to a total of thirty-three.

**Pre-Registration Details
for the APWA Congress
Appear on page 181**



DRAMATICALLY CLEAN sweeping with Tennant "100" reduces complaints, attracts public interest.

How to give your city an EXTRA-CLEAN name

From Maine to California, progressive cities take pride in the cleanliness of their downtown areas—as these are their public “showcases”.

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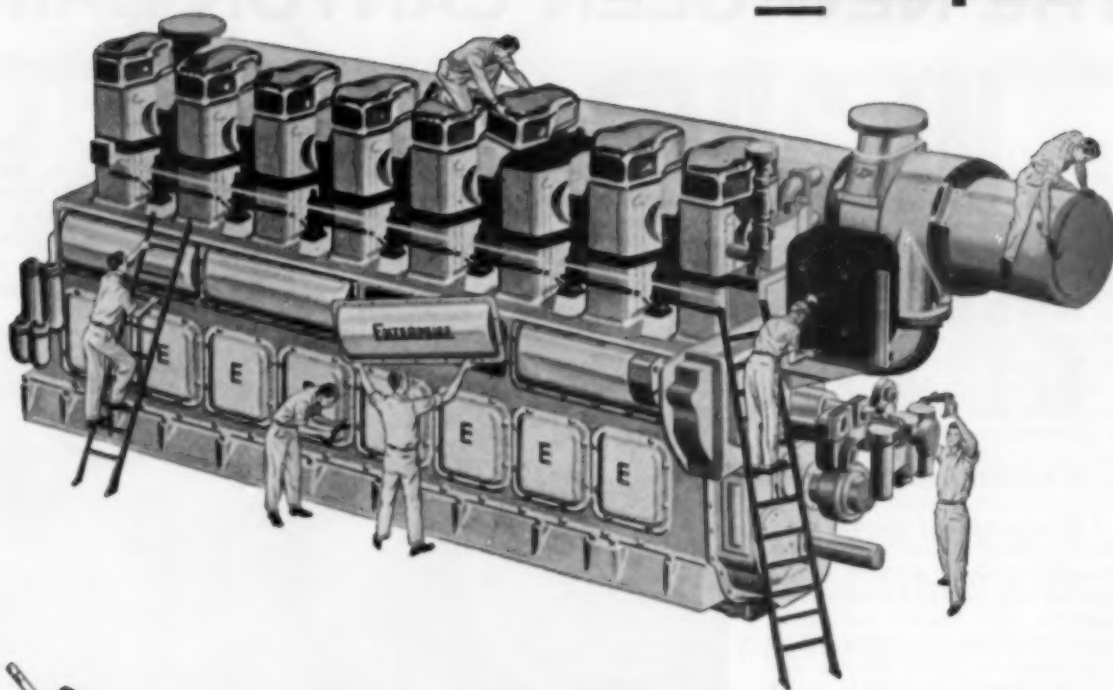
You'll find it trimly compact, highly maneuverable. Assures outstanding results in downtown areas, dusty alleys, parking lots . . . as well as in attractive residential areas.

WRITE TODAY for illustrated bulletins, photos and performance data. G. H. Tennant Co., 755G N. Lilac Drive, Minneapolis 22, Minnesota.



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SWEEPERS**

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**You'll find that ENTERPRISE accessibility
saves time, money and manpower
in maintenance and overhaul**



Ever watch precious hours slip by trying to find a way to dismantle, inspect or replace an engine part or assembly? Such unnecessary and costly down-time is something you don't have to worry about with modern, "easy-access" ENTERPRISE Diesels. For ENTERPRISE service-wise engineers have designed every model in the entire 73 to 2284 HP line for maximum accessibility and easy, low-cost servicing. That's why we say — and mean — you'll have less down-time if it's powered by an ENTERPRISE Dependable Diesel!



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PLACING CONCRETE FOR THE NEW GLEN CANYON DAM

THE Glen Canyon Dam, a concrete arch structure 700 feet high, with crest length of 1,550 feet and maximum thickness of 340 feet at the base, will form a reservoir of 28 million acre feet extending up the Colorado a distance of 186 miles and up the San Juan River tributary 71 miles. Integrated with it will be a 900,000-kilowatt power plant.

Excavation was begun in 1957. Placing the 4.83 million cubic yards of concrete required for the dam and power plant began this past spring and will require from three to four years for completion.

A \$4 million bridge, recently completed, spans the river 800 feet downstream of the damsite. It was built to help the construction crew build the dam, because without it, the trip from one rim of the canyon to the other entailed a 225-mile detour. In addition, 25 miles of access roads have been built.

Glen Canyon is part of an even bigger effort, the \$760 million Colorado River Storage Project. Its mainstream dams, 11 irrigation units, and power output will serve 3 million people in Colorado, Wyoming, New Mexico and Utah.

Concrete for the Glen Canyon Dam will be placed cold, and its temperature after placement will be lowered by operation of an imbedded pipe cooling system. Refrigeration is undertaken to reduce the temperature gradient between the interior and the surface of the concrete blocks, in order to prevent cracking; and to accelerate contraction of the blocks to minimum size in order to open joints between adjacent blocks sufficiently for grouting.

Refrigeration removes in one or two months heat that would otherwise require as long as 50 years to be dissipated. The concrete is cooled to grouting temperature, and then the cement grout is pumped into the joints.

A 4,000-ton refrigeration plant was designed by Lewis Refrigeration Co., Seattle (Wash.) refrigeration contractors. This plant was installed by Merritt-Chapman & Scott Corporation, general contractors for the Bureau of Reclamation project. It

keeps the mix in the 40° to 50°F range during placement and supplies coolant to blocks of mass concrete. It produces 35°F water for cooling the aggregate, makes 425 tons of ice per day, cools air for circulation through the aggregate bins, and pre-

Four No. A-175 FES-Fuller Rotary Booster Compressors, each driven by 125-hp motors and having a 150-ton capacity, were supplied by Lewis Refrigeration Co. as second stage to bring capacity up to the rated 4,000 tons pumping from 5 psig



● **LOOKING downstream:** This aerial view shows character of topography at damsite. Excavation is under way between the cofferdams; keyways indicate dam site.

pare a coolant that is circulated through coils to hold down temperature of the emplaced concrete.

Most of the ice produced at this plant is consumed in use as an additive in the mixing water. Some of the concrete placed at 50°F is further cooled to 40°F after emplacement.

to 45 psig. For maximum production in relation to a given refrigeration horsepower, ammonia is employed in the compressor.

Water for both the mix and the refrigeration plant is collected from several wells near the aggregate production plant, which is about five



TOPS IN TOWERS

Holan 5-Section Towers give you high-up stability and safety, glide up smoothly with pushbutton platform control.

44 SQUARE FEET OF WORK SPACE 30 FEET IN THE AIR. Crew members, working on 4' by 11' Holan tower platform to install fluorescent lighting. The 96-pound luminaire is raised to exact position with tower controls.

5 TELESCOPING BOX SECTIONS extend with the five telescoping cylinders that lift the Holan tower into the air. Result: maximum strength, stability and safety . . . and a smooth ride up. Platform equipment includes push-button controls for raising and lowering, a handle for rotation and a 3-foot safety railing. Everything folds neatly over the body for stowage. Holan's 5-section design permits installation of tower behind the cab on any chassis even though transmission might extend beyond rear of cab. Rotary, transverse and stationary towers are available—17', 23' 6", and 30' maximum heights.



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FLUORESCENT DYES such as Rhodamine B are the CHEAPEST, SAFEST, and most CONVENIENT tracers for studying mass flow and dispersion in liquids and gases.

The detection equipment is INEXPENSIVE, PORTABLE, and automatically records the concentration of dye, allowing you to examine the quantitative pattern in the field as it develops.

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- BORES—with no surface break
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 - BORES—up to six inches diameter
 - BORES—so drill stem of pipe of conduit stays
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miles from the dam site, and is transported in a 20-inch steel main to the refrigeration and mixing plants. Construction equipment and materials are trucked in from rail heads at Flagstaff, Ariz., Clarkdale, Ariz., and Marysville, Utah.

Six types of aggregate are produced at the heavy-media aggregate plant. This material is carried by trailer trucks to a drive-over hopper at the dam site, from which it is delivered to six stockpiles, one for each different type of aggregate. Two types of sand are similarly delivered and distributed to stockpiles by a radial stucker.

Air-operated clam gates, remotely controlled, draw material from the eight stockpiles into a 1,300-foot recovery tunnel. A 36-inch conveyor carries the material in the tunnel out about 500 feet beyond the mouth of the tunnel, where the aggregate receives its first chilling with ice water.


Coarse aggregates are dewatered. Fines are then drawn off through a 6 x 14-foot screen atop the 217-foot-high batch plant and the rest of the material is distributed among eight compartments, four of which store the four sizes of screened gravel, ranging from 6-inch to No. 4. Two others are used to store the two sizes of gravel processed through the heavy-media plant, and the remaining two receive the two types of sand. Total capacity for aggregate storage at this stage is 3,000 tons.

Cement, trucked in from Clarkdale, and pozzolana from Cameron, Ariz., are dumped onto drive-over receiving hoppers, and are then moved by Fuller-Huron "Airlide" fluidizing conveyors and bucket elevators to seven storage silos, three of which are charged with pozzolana, the rest charged with cement. Capacity of each silo is 10,000 barrels.

Fourteen-inch reclaiming screws feed material from these silos to twin 12-inch "Airlide" conveyors, which carry it to two 700-barrel silos at the concrete plant. From these, material is screw fed to individual weigh hoppers that automatically deliver the proper proportions of each type into process.

The batch plant has been set up on an almost inaccessible bench cut into the canyon wall 280 feet below the level of the canyon rim, on which the concrete silos stand. Thus all cement and aggregate are fed downgrade to the batch plant.

At the batch plant, proportioned materials are fed to six four-yard mixers. The completely automatic batch equipment can mix up to 480 cubic yards of concrete per hour. A



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When you specify Kerrigan lighting standards you get our octagonal shape, which is inherently stronger than the round or fluted; heavier wall thickness (.130); one continuous longitudinal weld magnafluxed for greater strength; and a guaranteed high yield point. Also 4 to 6 times greater resistance to corrosion and less deflection by our use of ASTM-A242-49T low-alloy, high-tensile steel. And last, but not least, you get a standard that has trim, modern lines, architecturally correct. That's why we say: "Make Your Standard Kerrigan!"

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KERRIGAN

IRON WORKS COMPANY

Nashville, Tennessee

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batch includes a metered quantity of shaved ice brought in by conveyor from the refrigeration plant via an insulated hopper, from which it has been fed by screw conveyor to the batch hopper.

Any of 12 different mix formulas may be automatically delivered into the collection hopper, the operator having only to push a button in order to program the desired formula.

Mixers can be used to mix and store as many as three different types of concrete at the same time. The mix is discharged successively into a partitioned wet-batch hopper of 65 cubic yards capacity, to 12-yd. dump cars and finally into buckets which place the concrete. The pouring operation is on a continuous batch basis, with down time only for the maintenance of equipment.

the chapter president to appoint a committee to study this problem and recommend a model street excavation ordinance. It was important that the membership of this study committee be composed not only of public works engineers but of utility engineers and contractors. This committee worked for more than a year before it finally produced an ordinance which was deemed acceptable. It was endorsed by the chapter, copies were made of it and distributed to all of the cities in the area, and since that time many of the cities have changed their ordinance and have adopted this model ordinance.

The Utilities Coordinating Committee of the San Diego-Imperial County Chapter of APWA was also cited by Mr. Vincenz. This group meets monthly to consider problems relating to advance planning for the location of utilities to be placed underground. They discuss the problems and arrive at an agreeable solution so that planning and construction can proceed with the least inconvenience to the utilities and loss of time and expense to the contractor.

Further studies have been made by a joint committee of the AGC and APWA. Some of the problems con-

Engineer and Contractor Cooperation

In a talk before the San Francisco meeting of the Associated General Contractors, Jean Vincenz, president of the American Public Works Association, spoke on the needs for cooperation and understanding between engineers and contractors. He pointed out that a few years ago each of the sixty cities in the Los Angeles metropolitan area, many of which are adjacent to one another, had, together with the County, separate ordinances and requirements for utilities cuts, excavations and backfills. A contractor awarded a contract by

a utility to lay a gas line, telephone conduit, or water or sewer line, extending through a number of these cities, found himself really in hot water. There was no particular intent on the part of the city engineers to be obnoxious, but they did have the ordinances which had been adopted by their city councils on these subjects to enforce. Without spelling it out, one can see the dilemma of the contractor in such a case.

Recognizing this problem, members of the Southern California Chapter of APWA voted to instruct

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Safety — the Plus factor built into PAK-MOR Bodies and La Boyes. Roomy, non-skid running boards and handy handholds give pickup men convenient and safe "out of traffic" riding areas. Side loading keeps men out of danger and PAK-MOR's round barrel keeps loaders in driver's sight at all times.



sidered and resolved by the committee are such that they can be carried to the membership through the separate publications of the two Associations. Committees of the APWA have developed Standard Specifications on a number of subjects and these are available to its membership. But conditions vary greatly throughout these United States. In the different regions there are differing soil and climatic conditions, and indeed in some areas even different philosophies that may pertain to construction programs. Procedures that may be of the highest type in the New York area may not be at all compatible with the problems and conditions in the Los Angeles area. Materials available in Texas may not be available in the Seattle area. Likewise, soil conditions encountered in Nebraska may be greatly dissimilar from those in Mississippi. In short, it is important to consider mutual problems on regional bases in individual areas and endeavor to arrive at joint decisions that make sense.

Entirely too few cities and governmental agencies have developed long-range public works planning programs. The City of San Francisco is one city that has done so, and has definitely benefited from the plan.

The plan is not new, but it does involve thinking ahead and taking an accurate, objective look at the needs of the community. Basically, the plan is this:

All of the departments are asked to give serious consideration to the public works needs of their departments over the next five, ten, or fifteen years. After those that are evidently pipe dreams have been screened, the public works engineer is requested to prepare general estimates of costs of the various items. Following conferences on justification of needs, the Chief Administrative Officer establishes a tentative priority list. This is then submitted to the legislative body which, of course, can change these priorities as it may desire. The Chief Administrative Officer then proceeds to tabulate these requests into a program scheduled over the five, ten, or fifteen-year period, coming up always with a total that is pretty startling to the community. The legislative body must then decide how it is going to secure the needed public works improvements within the periods of time when they must be provided.

The adoption of a program of this kind enables all of the governmental agencies in a community, such as the

school districts, the city, and the county, to establish a proper priority of improvements that may be submitted to the public, and for which approval may be expected. Actually, it is surprising how the taxpayers will face up to a program of this kind when they recognize that they cannot continue to put off these needed public improvements except at considerably increased costs and possible inconvenience.

• • •

Highway Lighting Called Too Low for Safety

Recommended practice in highway lighting may be 50 percent below the level needed for safely stopping a vehicle moving at 40 or 45 miles an hour, according to Dr. H. Richard Blackwell, director of Ohio State University's Institute for Research in Vision. Recommended practice is 0.2 to 1.2 footcandles. Dr. Blackwell's measurements show a need for 0.7 to 2.8 footcandles. Additionally, the curb lane—the lane which pedestrians enter when stepping from the sidewalk—requires about twice as much light for relative safety as the center of driving lanes.

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THE HIGHWAY AND AIRPORT DIGEST



Prepared by L. G. BYRD, Associate Editor

New County Highway Building

The county highway department of Hennepin County, Minnesota now occupies a new shop and office building on a 42 acre site near Minneapolis. Built at a cost of \$778,600, the structure is organized into working areas for administration, (7,071 sq. ft.) engineering, (6,221 sq. ft.) and maintenance (58,192 sq. ft.). Administration and engineering areas are air conditioned. The maintenance section, with a radiant-heated repair garage includes a booth for painting, washing or steam cleaning, a 10-ton traveling overhead bridge crane and modern lubricating and other garage equipment. Sectionalized parking areas, yard lights and expansion areas for all building sections are provided.

"New County Highway Department Building." *Better Roads*, April, 1960.

Successful Slurry Sealing

A conventional sled or slurry seal spreader box and a continuous flow pugmill type slurry mixing and spreading machine are the two methods used by Fresno, California in applying slurry seals to their streets. The continuous flow equipment was developed in the Fresno area. Field and laboratory testing of the characteristics of locally available aggregate and asphalt emulsion precede the formulation and application of the slurry. The sealing program schedule itemizing streets and nature of preparatory work required is based on a street inventory made by the engineering department. Thorough cleaning with brooms and water is followed by the leveling of excessive irregularities and patching of the surface to be sealed. Careful prior notice to all

affected residents minimizes the inconvenience to drivers and housewives and reduces the possibility of inadvertent damage to the uncured slurry by cars, bicycles or pedestrians. To avoid delays during the work progress, emphasis is given to equipment readiness before starting a project. A light tack coat (0.1 gal. psy) of 1 part SS-1 or SS-2 asphalt emulsion to 3 or 4 parts water is applied to the cleaned surface by pressure spray from a distributor. The slurry is then applied and spread in a film over 1/8-in. thick. Fresno employs a unique slurry design calling for a coarser aggregate with gradation ranging from 100 percent passing a 3/4-in. sieve to 10 percent passing a No. 200 sieve. Total cost for the city-performed sealing program amounted to 8.8 cents pay.

"Ten Steps For Successful Slurry Sealing." Alex Stenman, Superintendent of Streets and Sanitation, Fresno, California. *PUBLIC WORKS*, May, 1960.

Admixtures For Concrete

Late in the 1930's the Portland Cement Association made a thorough study of the phenomena of air entrainment in concrete which led

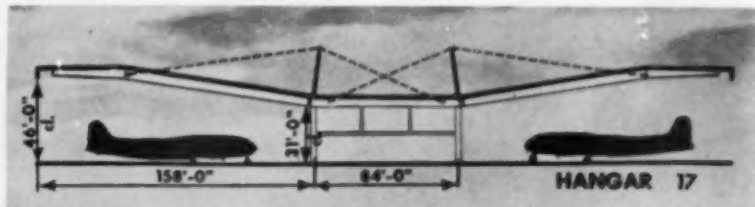
RADIANT HEATED CANTILEVER HANGAR

TO HEAT nine million cubic feet of hangar space quietly and efficiently, H. Sand & Co., Inc. of New York City, pipe contractors and engineers, has installed more than 111,000 feet of Republic Steel radiant heat pipe in New York International Airport's new Hangar 17. A suspended steel cantilever structure, the hangar is being built by The Port of New York Authority to provide the latest word in hangar appearance and practicability for five foreign flag airline tenants—Air France, BOAC, Lufthansa, Sabena and KLM.

In line with this, the hangar will have the latest word in heating systems, too. The hangar's six huge aircraft maintenance bays will be kept warm in cold weather by a

massive radiant heating system. The radiant heat pipe was laid in 18 sections, or panels, installed six inches beneath the hangar floor surface running to within six feet of the hangar doors (a separate heating system is used to keep the sliding doors free of ice). Two pumps, one for each of the two main sections, will circulate 2,240 gallons of hot water through the system per minute.

Each heating panel contains between 40 and 43 grids made from lengths of 1 1/2-inch pipe. The grids, each measuring 145 feet in length, are spaced about a foot apart and connected at either end to headers made of 3-inch pipe that complete the supply and return circuit for hot water.



● 111,000 FEET of Republic Steel radiant heat pipe is installed beneath floor.



Michigan digs, loads pit-run gravel in less than half the time previously required.

How Great Falls s-t-r-e-t-c-h-e-d maintenance budgets 20%

Faced by the universal problem of rising demands and level budgets, the City of Great Falls, Montana, 18 months ago turned to the mobility of rubber with dramatic results.

After testing all available machines, the City chose a 1½ yd Model 85A Michigan Tractor Shovel. "It handled better . . . showed more power and digging ability . . . operators had better vision than on comparable units," explains Street Supt William Swingley.

Performance of this power-steered, power-shifted, four-wheel-drive Mich-

igan was so good the City six months later bought a second Model 85A.

Today—counting all costs—the two Michigans are doing *so much more work* city officials can schedule 20% more street, alley and water-main building and rebuilding per dollar of budget.

Save hours of travel time

Michigan 26 mph go-anywhere mobility accounts for some of the increase. Mr. Swingley reports a Michigan often travels to a job, completes it, and is on its way again before crawlers could have been trailer-loaded and hauled one-way.

60% faster loading trucks

Similar advantages have been demonstrated on the job. Loading hard-packed

pit-run gravel, for instance, a 96 hp Model 85A needs only 2 minutes, often less, to heap a 6 yd truck. Same job with 1-yd crawler-loader used to take 5 minutes.

Save \$1,000 yearly repair costs

Output has been equally good on other assignments around this city of 60,000 and its 202 mi of streets, 67 mi of alleys. In winter, Michigans load grader-windrowed snow . . . take about a minute to fill a 6-yd truck. Summertime they feed a hot-mix plant (typical one-machine output: 35 tons of ¾" and ¾" stone hourly). Units also pick up street sweepings, backfill water trenches. "In the 12 and 18 months we've had the two Michigans," says Supt Swingley, "We've spent no money at all on repairs!"



Another of Michigans' many jobs: handling water pipe. This section is 16' long, weighs 2,000 lbs. Machine can lift 9,000 lbs.

8 Models Now Available

12B	16 cu ft	125A	2 yds
55A	1 yd	175A	2¾ yds
75A	1¼ yds	275A	4 yds
85A	1¾ yds	375A	6 yds

Name the model, place, and date.
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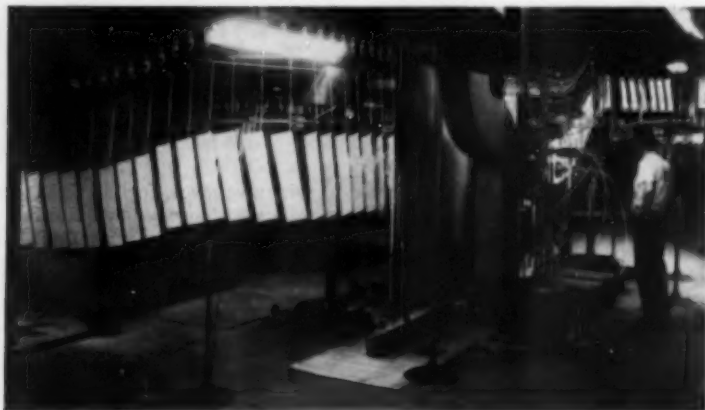
New sign materials and processes and modern methods of handling the old, provide important new ways to solve your signing problems. And Lyle, as a manufacturer of quality street marker and traffic control signs, has available all types of sign materials and styles to meet your various requirements. That's why the experience of LYLE's sign representatives in helping to solve signing problems for dozens of cities and towns can be so valuable to you now.

And, whatever materials you select, Lyle's know-how assures you of highest quality. For example, tested and time proven, the steel blanks are a hot dipped, continuous process galvanized material, bonderized after fabri-

cation. This special steel Lyle uses costs so little more than non-rust proofed material—yet lasts many times longer. Available too, are various types and gauges of aluminum sheeting and extrusions, and high density plywood.

Consider also finishes. Choose from baked enamel or reflective materials. Available are the latest and most improved types of reflector buttons, reflective sheeting, reflective spheres applied directly by Lyle to binder material overlaid on baked enamel, and reflective liquid coating.

Processes available include Lyle's famous deep embossing for highest legibility due to 3rd dimension, flat lettering and screen processing.



When baked enamel finish is indicated, LYLE provides the highest quality you can buy, and at competitive prices. The photo above shows a section of Lyle conveyor type baking ovens. Specially formulated paints are applied with controlled pressure. Then, carefully timed at controlled temperature, the finish is baked for a sparkling lustre, free from blemishes, blisters or cracks of any kind. Presto! An attractive, durable sign.

Write for Lyle's free Sign Manual 8-55 and the name of your nearest Lyle Sign Representative, if you don't already know him.

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to the first generally accepted practice of adding air entraining agents at the job-site mixer or ready-mix truck. Calcium chloride was investigated at an early date because of its ability to accelerate set; and other admixtures were studied. After an early history littered with cure-all concoctions, the admixture business today is generally conducted on a responsible level, primarily by good concrete engineers. While all concrete authorities do not endorse the use of admixtures, a majority of them are now favorably inclined to one or more. However, the need for tight specifications and careful construction supervision in the design and control of concrete mixes has not been adequately met by many engineers. One significant endorsement of admixtures is contained in the ACI Committee 212 Report in which it is recommended that their development and study be commended and fostered. The Bureau of Public Roads in a study of air-entraining admixtures and other reports such as that conducted by the National Sand and Gravel and National Ready Mixed Concrete Associations now offer specification writers the added advantage of chemical identification of most admixtures. The use of calcium chloride in small quantities is now recognized by both the Portland Cement Association and in ACI Standards. Currently water reducing and set retarding admixtures are also getting increased attention and acceptance.

"Admixtures . . . Fifth Ingredient For Concrete." *Consulting Engineer*, April, 1960.

Unique Lighting for Downtown Fringe

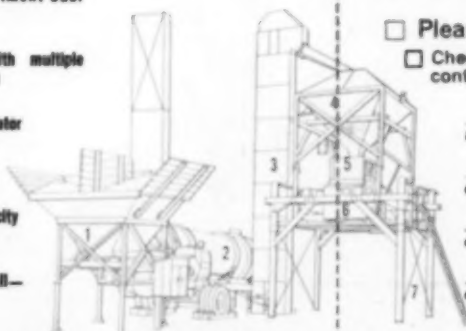
A progressive rehabilitation program of the southern edge of the Louisville, Kentucky downtown business district, begun in 1957, included a complete replacement and upgrading of street and alley lighting. The 6000-lumen incandescent street lights, spaced 300 ft. apart were replaced with 400-watt, 25,000-lumen color-corrected mercury vapor street lights placed on alternate sides of the street approximately 160 ft. apart. Alley lights were placed 200 ft. apart. Lights were mounted on 6 to 12-ft. mast arms in the streets and 2-ft. mast arms in the alleys 30 ft. above the pavement surface. Light meter readings taken at early installations showed 0.3 footcandle midway between new alley lights and 0.5 footcandle between street lights. These high

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The rugged Littleford Asphalt Plant is built to do the job . . . gives big plant quality mixes at small plant costs. Savings of 40% on producing bituminous black top are possible because you control the mix from pugmill to pavement. No more costly delays and waiting for trucks to arrive with the hot mix . . . with the Littleford Model 121-30 you have a plant with the flexibility and versatility to produce all types of black top mixes at the lowest possible cost. Only the Littleford Plant incorporates so many new and improved designed features and offers such a complete line of auxiliary equipment for you to custom-make a plant for your operations. You receive all the profits with **A LITTLEFORD MODEL 121-30 ASPHALT PLANT.**

1. 5-ton, 2-compartment dual feeder bin
2. 30-ton dryer with multiple flight construction
3. Enclosed hot elevator
4. Storage Hopper
5. 10 cubic foot capacity Batching Hopper
6. Twin Shaft Pugmill—1000 lb. batch
7. Self-elevating platform



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Littleford offices in Cincinnati, Ohio and Albany, New York

What signs shall I specify?

LYLE'S SIGN SERVICE HELPS YOU DECIDE



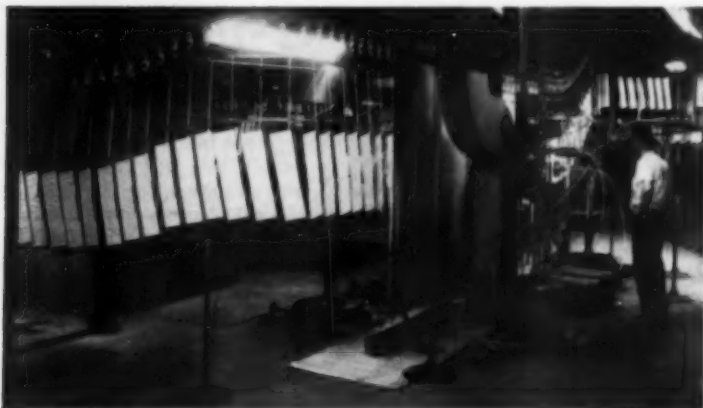
New sign materials and processes and modern methods of handling the old, provide important new ways to solve your signing problems. And Lyle, as a manufacturer of quality street marker and traffic control signs, has available all types of sign materials and styles to meet your various requirements. That's why the experience of LYLE's sign representatives in helping to solve signing problems for dozens of cities and towns can be so valuable to you now.

And, whatever materials you select, Lyle's know-how assures you of highest quality. For example, tested and time proven, the steel blanks are a hot dipped, continuous process galvanized material, bonderized after fabri-

cation. This special steel Lyle uses costs so little more than non-rust proofed material—yet lasts many times longer. Available too, are various types and gauges of aluminum sheeting and extrusions, and high density plywood.

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When baked enamel finish is indicated, LYLE provides the highest quality you can buy, and at competitive prices. The photo above shows a section of Lyle conveyor type baking ovens. Specially formulated paints are applied with controlled pressure. Then, carefully timed at controlled temperature, the finish is baked for a sparkling lustre, free from blemishes, blisters or cracks of any kind. Presto! An attractive, durable sign.

Write for Lyle's free Sign Manual 8-55 and the name of your nearest Lyle Sign Representative, if you don't already know him.



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to the first generally accepted practice of adding air entraining agents at the job-site mixer or ready-mix truck. Calcium chloride was investigated at an early date because of its ability to accelerate set; and other admixtures were studied. After an early history littered with cure-all concoctions, the admixture business today is generally conducted on a responsible level, primarily by good concrete engineers. While all concrete authorities do not endorse the use of admixtures, a majority of them are now favorably inclined to one or more. However, the need for tight specifications and careful construction supervision in the design and control of concrete mixes has not been adequately met by many engineers. One significant endorsement of admixtures is contained in the ACI Committee 212 Report in which it is recommended that their development and study be commended and fostered. The Bureau of Public Roads in a study of air-entraining admixtures and other reports such as that conducted by the National Sand and Gravel and National Ready Mixed Concrete Associations now offer specification writers the added advantage of chemical identification of most admixtures. The use of calcium chloride in small quantities is now recognized by both the Portland Cement Association and in ACI Standards. Currently water reducing and set retarding admixtures are also getting increased attention and acceptance.

"Admixtures . . . Fifth Ingredient For Concrete." *Consulting Engineer*, April, 1960.

Unique Lighting for Downtown Fringe

A progressive rehabilitation program of the southern edge of the Louisville, Kentucky downtown business district, begun in 1957, included a complete replacement and upgrading of street and alley lighting. The 6000-lumen incandescent street lights, spaced 300 ft. apart were replaced with 400-watt, 25,000-lumen color-corrected mercury vapor street lights placed on alternate sides of the street approximately 160 ft. apart. Alley lights were placed 200 ft. apart. Lights were mounted on 6 to 12-ft. mast arms in the streets and 2-ft. mast arms in the alleys 30 ft. above the pavement surface. Light meter readings taken at early installations showed 0.3 footcandle midway between new alley lights and 0.5 footcandle between street lights. These high

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The rugged Littleford Asphalt Plant is built to do the job . . . gives big plant quality mixes at small plant costs. Savings of 40% on producing bituminous black top are possible because you control the mix from pugmill to pavement. No more costly delays and waiting for trucks to arrive with the hot mix . . . with the Littleford Model 121-30 you have a plant with the flexibility and versatility to produce all types of black top mixes at the lowest possible cost. Only the Littleford Plant incorporates so many new and improved designed features and offers such a complete line of auxiliary equipment for you to custom-make a plant for your operations. You receive all the profits with **A LITTLEFORD MODEL 121-30 ASPHALT PLANT.**

1. 5-ton, 2-compartment dual
feeder bin

2. 30-ton dryer with multiple
flight construction

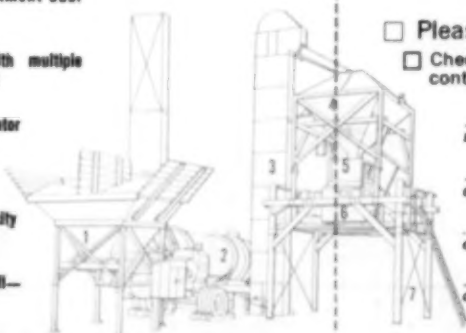
3. Enclosed hot elevator

4. Storage Hopper

5. 10 cubic foot capacity
Batching Hopper

6. Twin Shaft Pugmill—
1000 lb. batch

7. Self-elevating platform



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Littleford offices in Cincinnati, Ohio and Albany, New York



OLD STREETS MADE NEW

THE LITTLEFORD-CLARKMOORE HEATER-PLANER

When pavements made from Bituminous materials . . . become wavy, bumpy or corrugated, the Littleford-Clarkmoore method of heating-planing should be used to correct these conditions. Excellent riding qualities can be restored and the life of the pavement extended for many years at unbelievably low cost. The problem of disappearing curb heights, resulting from resurfacing, is quickly corrected at extremely low costs. The Littleford-Clarkmoore Heater-Planer achieves results in street maintenance impossible by other methods.



The Littleford Heater-Planer Consultant, a nationally known expert in Street and Highway Maintenance, travels thousands of miles yearly conferring with City and Highway Officials. His suggestions are used by many of the country's largest cities as a basis for their modern programs of street maintenance. Take advantage of our consultant's experience . . . have him arrange a meeting with your officials!

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Illustrated above are a few of many of the cities and states across the country where the Littleford-Clarkmoore Heater-Planers are located. Use the postage-free air mail reply card to have Littleford's Heater-Planer Consultant contact you

ALL-NEW PAYLOADER®



The MODEL H-30 with 4-WHEEL DRIVE is a natural for city and town work. In spite of its compact size and modest price, it boasts the latest improvements and features of larger "PAYLOADER" units that give it performance, safety and operating advantages not found in any comparable machine:

Four-Wheel Brakes: Powerful hydraulic type, and sealed to keep out dust and dirt.

Full Power-Shift Transmission plus torque converter: Three speed ranges in each direction. All shifts in either direction made with fingertip effort, "on-the-go". No foot clutching.

Visibility and Safety: New slope-down front end lets operator see bucket-loading action. Fixed ladder and hand rails let operator get in and out safely.

Closed Hydraulic System: Oil reservoir is sealed and pressurized to keep out air-borne dust and dirt. Includes cartridge-type oil filter and fine mesh strainer.

Positive Oil Cooling: Separate fan-cooled oil-to-air radiator assures positive cooling of transmission and torque-converter oil.

"Operator's Choice" Brake Pedals: Dual pedals give the operator a choice of braking with or without transmission engaged.

Maximum Accessibility: Fuel tank and transmission can be checked and filled from ground level. Easy access to battery, engine and other necessary points.

Contact your nearby Hough Distributor or write for more information and a demonstration of this H-30 or any other "PAYLOADER" model from 2,000 to 12,000-lb. operating capacity.

HOUGH, PAYLOADER, PAYMOVER, PAYLOGGER and PAY are registered trademark names of The Frank G. Hough Co., Libertyville, Ill.

- **OPERATING CAPACITY 3,000 LBS.** — 1-cu. yd. bucket.
- **77 1/2-H.P. GAS ENGINE** has 17% more H.P. than next most powerful in its class.
- **DUMPING CLEARANCE** of 8'4" is 4" more than any in its class.
- **DUMPING REACH** of 29" ahead of tires is a foot more than any in its class.
- **FOUR-WHEEL BRAKES** are exclusive on the H-30 in its class.
- **SAFETY BOOM ARMS**—with all moving parts ahead of the operator—is another H-30 exclusive.

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LIBERTYVILLE, ILLINOIS
SUBSIDIARY — INTERNATIONAL HARVESTER COMPANY



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- ☐ Send data on new H-30 "PAYLOADER"
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Gov't. Unit _____

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4-B-5

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LOOK . . .

- ★ **Speeds** up to 1200' per hour; depths — 1½" through 4½"; widths — 2¼" through 8".
- ★ **Power Boom Control** permits fast raising and lowering of boom for rapid trenching; depths are accurately controlled, eliminating guesswork.
- ★ **Reversible Dirt Conveyor** is standard equipment — deposits dirt at selected distance from either side of trench. In only 60 seconds, conveyor may be switched from one side to the other.
- ★ **Easy Transporting** — under its own power, the self-propelled Model MA-2 may be run up skids, into a pickup truck, or driven at 2¼ M.P.H. One man loads — transports — unloads — trenches.
- ★ **Smaller Model JR Trench-Devil** digs 2¼" or 3½" wide, up to 20" deep. Simple, one-man operation and fast — speeds of 15 feet per minute at a 12" depth.

Write today for full details on both models. Dept. PW.

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CORPORATION
NEW HOLSTEIN,
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TRENCHERS • HALF-TRACKS
BULLDOZERS • UTILITY BLADES



standards of illumination are expected to encourage the improvement of the general character of the area through reduction of crime and traffic accidents and the promotion of new or improved buildings. The system scheduled for completion in May, 1960, is installed, operated and maintained by the Louisville Gas and Electric Company at an annual rental rate to the City of \$63 per street light.

"Unique Lighting Program for a Downtown Fringe Neighborhood." W. F. Watkins, Director, Department of Traffic Engineering, Louisville, Kentucky. *Street Engineering*, April, 1960.

Highway Executives Study Management

At the request of the Wisconsin State Highway Commission the Management Institute of the University of Wisconsin, which had conducted many comparable seminars for private industry, developed and presented a course geared to the needs of the commission's highway management group. The 28 participants included two of the three commission members, top highway engineering officials including district engineers and other officials in finance, personnel, right-of-way, statistics, administration and public information. The subjects covered included: Leadership, human relations, motivation, communications, self analysis and development and management analysis and development.

"Highway Executives Study Management Methods." By Harold J. Roche, Chief of Public Information, Wisconsin State Highway Commission. *Better Roads*, April, 1960.

Soil Cement Streets

Climatic conditions in North Dakota subject pavements to temperature differentials as great as 150°F. Because of the excellent condition of soil cement pavements which have been in service for a number of years, and because this type of construction permits use of local, economical materials, wider use of soil cement streets and highways is predicted for North Dakota in the future. Equipment used on a typical street job included a P & H single-pass soil stabilizer and auger for unloading cement, a Hercules bulk cement spreader, sheepfoot roller and tractor, one pneumatic and one self-propelled steel roller, a spring-tooth drag and tractor, two motor



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Acker diamond bits will do the most exacting job better and more economically. They're expertly designed and crafted of the finest materials and workmanship in Acker's new, ultra-modern plant. Complete inspection and quality control plus Acker's impeccable reputation for reliability and dependa-

bility are your guarantee of satisfaction. Try an Acker bit on your next job, you'll be pleased with its rugged construction and ability to stand-up under the most severe conditions.

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Bulletin 10PW



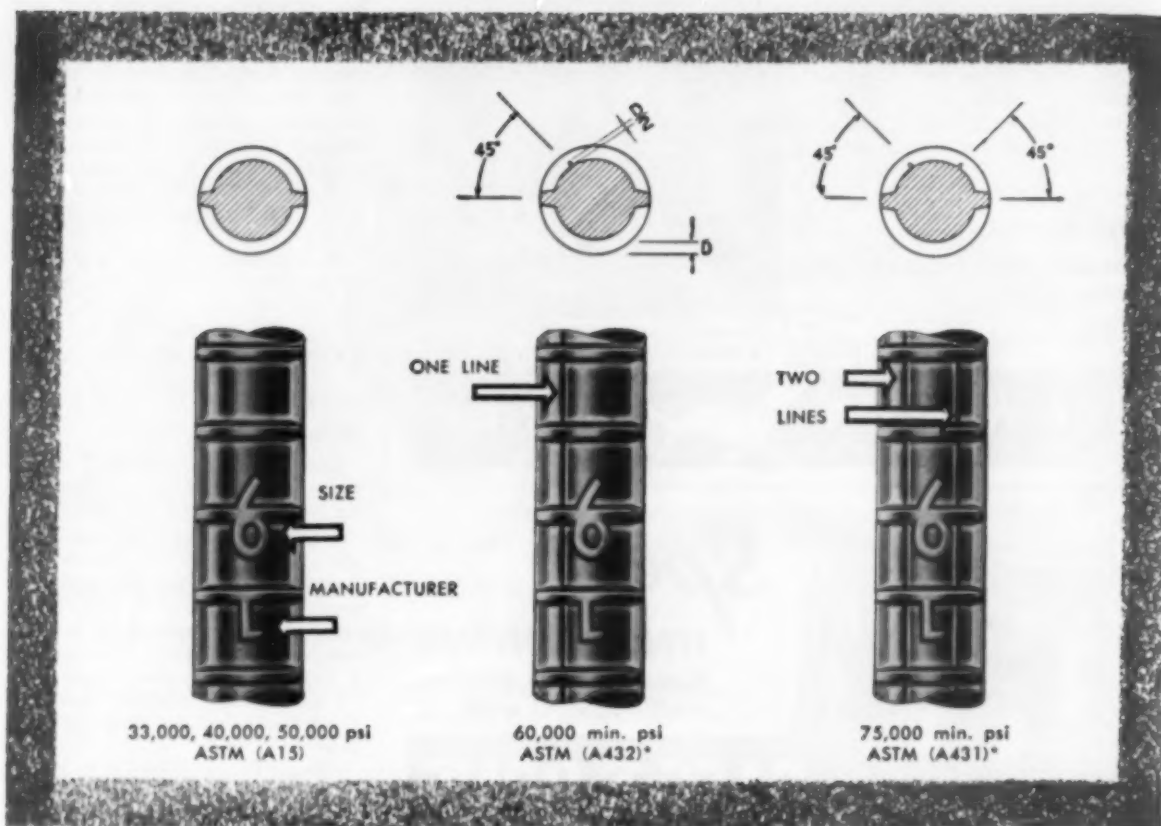
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Manufacturers of a complete line of: Soil Sampling Tools • Rotary Earth Augers • Diamond & Shot Core Drills • Earth Boring Equipment • Diamond Bits • Drilling Accessories & Supplies

NOW...

Every LACLEDE Multi-rib Reinforcing Bar is Marked to Show SIZE and STRENGTH...



Standard high strength steels* permitting greater economy and efficiency in reinforced concrete design under the provisions of the new A.C.I. codes must be identified. Recognizing this need, each Laclede Multi-rib reinforcing bar can now be completely identified as to size, strength and origin through a new rolled-in marking system. This assures the designer, contractor, and code writer that the proper grade of reinforcement is used on the job.

Demand these new time-saving Laclede bars for your next construction job.



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Producers of Steel for Industry and Construction

Now... a 6 minute splice for Rubber Waterstop

To splice Gates new Kwik-Seal Rubber Waterstop, all you need is a small splicing kit and simple clamping device. This eliminates the need for a field vulcanizer, molded parts, a power supply or heat.

The Gates Kwik-Seal splice is chemically bonded. The strength of the bond often exceeds the strength even of the rubber—far stronger than government requirements. One man makes this strong, permanent splice in just 6 minutes—5 times faster than with former methods!

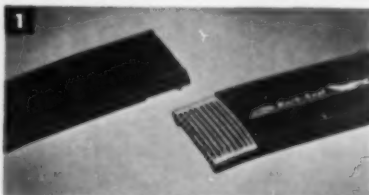
As a result, this new Gates splicing method cuts your labor costs and speeds the job.

WRITE FOR CATALOG and splicing demonstration.

The Gates Rubber Co. Sales Div., Inc.
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TPA 977-A



1 Apply Kwik-Kem bonding chemical to prepared surface.



2 Clamp Waterstop firmly for 5 to 6 minutes... and it's spliced.

Gates Kwik-Seal Waterstop



Speed

LINE PAINTING
through more efficient
traffic control with...

SAFE-T-CONE
TRAFFIC GUIDES

All-rubber
SAFE-T-CONES

available
in 3 sizes



28-Inch

18-Inch

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**SAFE-T-CONES are used coast-to-coast
to solve modern traffic problems!**

SAFE-T-CONES are proven and accepted by Federal, State and Municipal Traffic Authorities in hundreds of major cities. SAFE-T-CONES command attention wherever used. Ease-of-handling makes them adaptable to all situations at a moment's notice.

**NEW, solid-color PVC*
POLY-CONE available!**

Colored *Poly-vinyl-chloride outlasts ordinary cones without upkeep!

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RADIATOR SPECIALTY CO.
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Adaptors for signs, flasher-lights and flags convert ordinary SAFE-T-CONES to special purposes.

graders, three water trucks, a bituminous spreader, chip spreader and required dump trucks. The job, consisting of 300,000 square yards of 6-in. soil cement base topped with a double bituminous surface, averaged \$1.12 per square yard constructed by contract. Construction procedure involved shaping to proper crown and grade and removal and replacement of pockets of unsuitable material. Cement was then spread on the surface by dump trucks and cement spreader. Mixing at a depth to give a 6-in. compacted base was accomplished with the single-pass mixer which added water through a metered pump. The sheepfoot roller was followed by the spring harrow to remove compaction planes, re-shaping with the motor grader and finishing with the pneumatic and steel-wheeled rollers. Daily production rates reached 8,500 square yards.

"Soil-Cement Streets Are Good for Both City and Contractor." A. J. Kovash, President, Kovash, Inc., Dickinson, North Dakota. The American City, April, 1960.

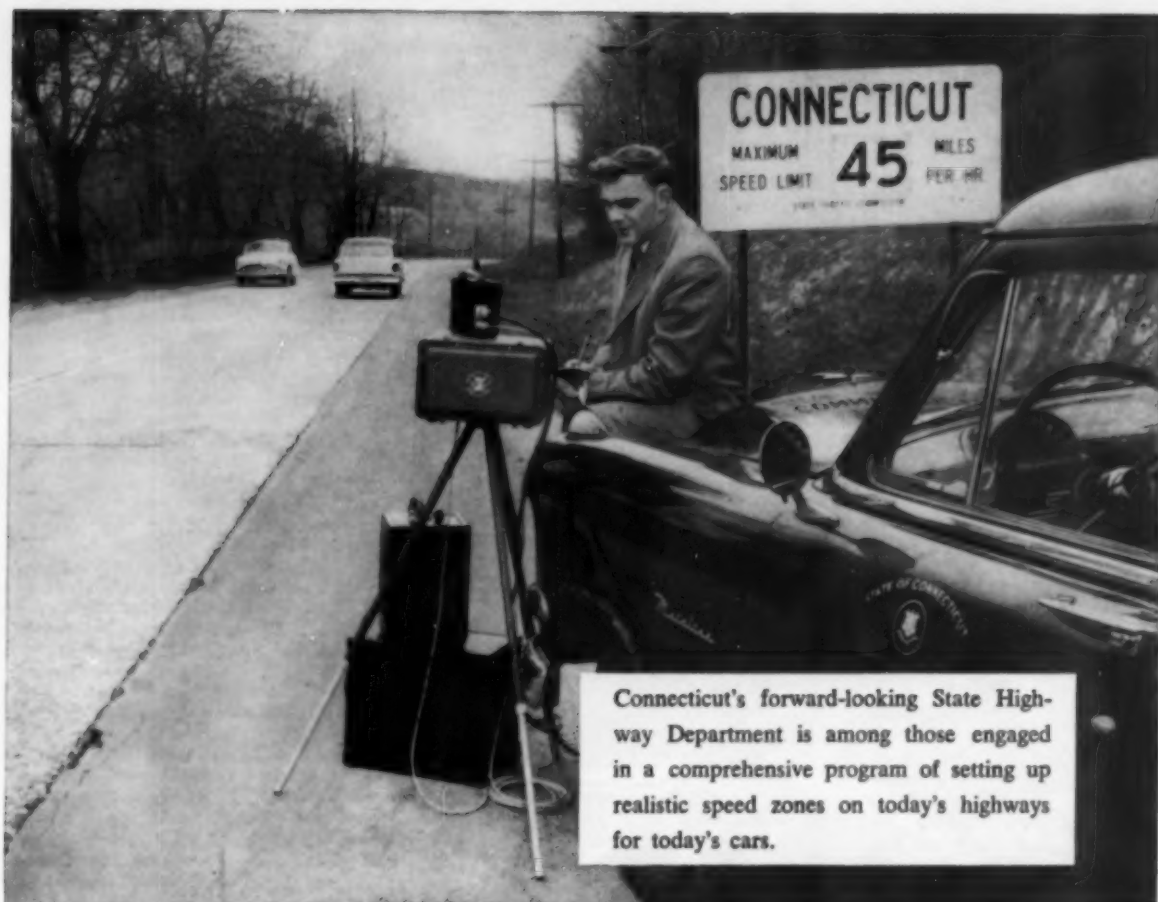
Residential Street Construction

Two blocks of residential streets were constructed by Hellertown, Pa. on grades of 14 and 17 percent. Concrete curb and gutters were placed by contract before the Borough forces started pavement construction. The 25-ft. wide pavement section consisted of 6-in. of compacted slag base penetrated with a C-1 cut-back asphalt applied at 1.5 gal. per sq. yd. and covered with a 2-in. bituminous-mix wearing surface.

"Grade Causes Problem in Building Residential Streets." Frank Force, Borough Manager-Engineer, Hellertown, Pennsylvania. PUBLIC WORKS, May, 1960.

Maintenance of Bituminous Pavements

Patching and sealing of bituminous pavements is a well developed program in Milwaukee, Wisconsin. An annual spring inspection of the city's 1200 miles of streets and 400 miles of alleys provides the information from which the seasonal work program is developed. Approximately 50,000 tons of various bituminous mixes used annually are produced by the municipal asphalt plant. Some 45 crews totalling about 500 men carry out the program in the five maintenance districts. The 1960 budget for the street main-



Connecticut's forward-looking State Highway Department is among those engaged in a comprehensive program of setting up realistic speed zones on today's highways for today's cars.

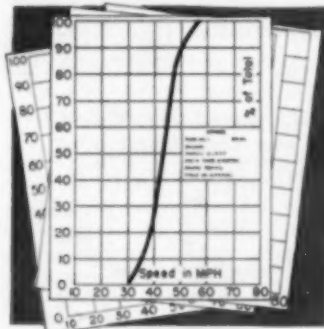
ELECTRO-MATIC[®] RADAR assures realistic speed limits . . .

The first essential in the process of setting zone speeds is the determination of current speed patterns. The Electro-Matic Radar Speed Meter is now the accepted means by which traffic engineers obtain speed characteristics of vehicle flow on all types of highways.

Highly accurate under all conditions of traffic and weather, it is inconspicuous and operates without contact-making devices on the road surface. The Meter is easily portable and requires only one man for operation. It can be set up in less than three minutes. Operation is on 6 Volt or 12 Volt battery or 120 Volt A.C.

A Graphic Recorder provides a permanent record for study and

analysis leading to the preparation of speed distribution curves and other data essential to instituting a realistic system of speed zoning that goes hand in hand with modern enforcement techniques.



AUTOMATIC SIGNAL DIVISION
EASTERN INDUSTRIES, INC., NORWALK, CONN.

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tenance division is \$2,379,000. A repair and sealing program on the tar penetration macadam pavements includes repairing pot holes and depressions with 85/100 asphalt cement tack coat and a hot tar premix followed by sealing of the entire street surface with RT-9, 10 or 11 at 0.3 gal. per sq. yd. and cover grit at 15 to 17 lb. per sq. yd. Older asphaltic concrete pavements are repaired in the same manner. Newer (less than 20 years old) asphaltic concrete pavements are repaired by removing failed material down to sound base, trimming to sound square edges, applying tack coat to

base and edges, placing and compacting binder course to 1½ in. below surface and laying and rolling an asphaltic concrete surface course. No further sealing is required on this type of repair.

"Maintenance of Bituminous Pavements in Milwaukee," Walter L. Burmeister, Assistant Superintendent of Street Maintenance, Milwaukee, Wisconsin. *Street Engineering*, April, 1960.

Other Articles

"Rural County Builds Low Cost Roads." More than 60 miles of soil-

cement paving have been placed by Fulton County since 1950. By Karl Mohr, County Engineer, Fulton County, Ohio. *PUBLIC WORKS*, May, 1960.

"Developments in Asbestos-Asphalt Paving Mixes." Experimental tests indicate substantial benefits in pavement life, performance and maintenance by the addition of 2 to 3 percent asbestos fibre to asphalt paving mixes. *PUBLIC WORKS*, May, 1960.

"Method Specification vs End-Result Specification—Highway Engineer Viewpoint." The expanded highway program and the development of improved construction equipment have produced a problem for the engineer in developing specifications that will permit efficient use of this equipment without endangering construction quality. By Keith Rosser, New Jersey State Highway Department. *Construction*, April 4, 1960.

"Highway Maintenance." Detailed standard procedures for the various phases of maintenance have been assembled in pamphlet form by the North Carolina State Highway Commission. By B. W. Davis, State Highway Commission, Raleigh, North Carolina. *Roadways*, March-April, 1960.

"Safety Seminars for Maintenance Workers." Maintenance foreman is key man in Colorado campaign to cut worker accidents and insurance costs. *Roads and Streets*, April, 1960.

"Contractors Doing More Testing on Their Own." Ninety-one percent of surveyed state, county and federal engineers favored own protection. By Theodore W. Van Zelst, President, Soiltest, Inc. *Roads and Streets*, April, 1960.

"Ohio Salt-Stabilizes 130 Miles." New projects raise Ohio's salt-treated roads on the state system to 681 miles. *Roads and Streets*, April, 1960.

"The Engineer in Sales - Human Catalyst." The successful sales engineer must have self-discipline, an outgoing personality, physical stamina and a high degree of ambition to move ahead in his chosen branch of the profession. By Hugh A. Young, Consultant-Technical Marketing, Los Angeles, California. *The American Engineer*, April, 1960.

"Ironing Out The Traffic Kinks of Auburn & Lewiston, Me." The two cities, linked by bridges, share a common traffic problem. *The American City*, April, 1960.

"Time and Fuel Consumption for Highway-User Benefit Studies." By the Division of Traffic Operations, Bureau of Public Roads. *PUBLIC WORKS*, April, 1960.

• • •

Costs of Sewage Treatment

It cost New York City \$26.79 per million gallons for sewage treatment in 1959; the cost of dry solids removed per ton was \$31.65. These figures compare with \$15.85 per million gallons and \$22.94 per ton for 1947.

PUBLIC WORKS for June, 1960

TAKE A LONG LOOK AHEAD BEFORE BUYING SIGNS



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EMBOSSED SIGNS GIVE YEARS OF EXTRA SERVICE

You can be sure you're making the best buy in street name assemblies and traffic control signs when they are Miro-Flex. These high-quality signs are embossed to provide extra strength, rigidity, and legibility. They are finished to perfection for years of service in the most rugged of conditions. Miro-Flex can fulfill practically all your sign requirements and at prices that fit your budget year after year. Write for your free copy of the Miro-Flex catalog and prices.



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Two passes with unballasted DUO-PACTOR meets density specs on sand and low bearing materials.

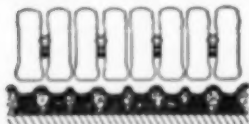
If you are thinking of **COMPACTION**, these **DUO-PACTION** facts may help you:

Contractors' cost records on scores of interstate, state, and county contracts reveal these amazing savings: Compared with previously used methods and equipment

DUO-PACTORS cut compaction time as much as **75 per cent** on many jobs

DUO-PACTORS required less horsepower by one-third to one-half.

The result is compaction—meeting the most rigid density specifications—at some of the *lowest costs ever achieved!* These savings are made possible by the exclusive DUO-PACTION principle of combining high-pressure compaction tracks (pneumatic) and high pressure ridge rolling (steel) to produce uniform, high density.



The closely spaced tires form densely compacted tracks with minimum material displacement.

Since density is a matter of compressive values, DUO-PACTION first of all provides greater compressive pressure than conventional pneumatic compactors, per ton of overall weight or pounds per wheel. Spring

mounting of tires in pairs applies uniform surface pressure over the entire rolling width. Small tire contact area eliminates bridging.

Second, close wheel spacing permits higher surface loading without material displacement, thus developing higher densities.

Third, you get selective load control—both rubber and steel rolls can be moved forward or backward, on-the-go, to vary loading.

Finally, you can handle more types of compaction and surface rolling jobs with a DUO-PACTOR than with any other compactor ever before available. You slash your investment in compaction equipment to the bone! Write or 'phone today for name of your Seaman-Gunnison DUO-PACTOR Distributor.



Lowering the steel roll chokes ridged material down between the tire tracks, unifying density.



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ESSICK VIBRATING COMPACTORS



ESSICK VR-28-W PATCHING ASPHALT IN GARDEN GROVE, CALIF.

"MAINTENANCE PRODUCTION TRIPLED... ... COSTS DECREASED 80%"

SEWARD H. DART, STREET MAINTENANCE SUPERINTENDENT—SHOWN WATCHING HIS 28" ESSICK VIBRATING COMPACTOR IN ACTION—STATES:

"Irrigation water tracked into the intersections and gutter aprons in Garden Grove, constantly eroded the asphalt and made maintenance a full time problem. As a result, our gutter and intersection patching required frequent reworking, and our costs were high.

"After a demonstration of the 28" Essick Vibrating Compactor, we knew we had found the answer. It was self-propelled, hooked on the tail gate of a dump truck, and produced compaction equivalent to an 8 ton roller on asphalt. Its high frequency vibration compacts an asphalt patch that is completely dense—that can be opened immediately to traffic without any marking or damage to the asphalt.

"Now with our patching unit consisting of the 1½ ton dump truck, an Essick 120 gallon Truck Mounted Emulsion Unit, a propane torch, and the Essick VR-28-W Vibrating Compactor, the patch life has been tremendously extended, our maintenance production has tripled, and our costs have decreased 80%.

"The Essick VR-28 really solved the patch problem for us."

SELF PROPELLED — MANEUVERABLE — PORTABLE

Essick High Frequency Vibrating Compactors are constantly exceeding the densities and specifications performed by other compaction methods, while creating new standards of compaction for all types of fills, sub base, base materials, and asphalt.

CALL YOUR ESSICK DEALER FOR A DEMONSTRATION



5 Models of Vibrating Compactors from 1½ to 7½ Tons

Also 14 models of Tandem Rollers from ½ to 14 Tons

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Affiliated with THE T. L. SMITH COMPANY, Milwaukee, Wisconsin

Chemical Soil Stabilizing and Grouting

An entirely new concept of soil stabilization and grouting—the development of a chemical that turns water into a stiff continuous gel in a controlled period of time, has been announced by American Cyanamid Co. Known as AM-9, chemical grout, it was designed for application in the mining and construction industries to prevent various types of water seepage. It is available as a dry white powder and is applied in a non-viscous solution which will penetrate any mass through which water flows.

After the addition of a catalyst, an aqueous solution of AM-9 is injected or percolated through the soil or rock formation. Gelling time is controlled from a few seconds to several hours, depending on the type of catalyst used. The nature of the reaction is such that the viscosity of the solution remains essentially that of water until just before the gel forms.

The gel not only prevents the passage of water through the mass, but also binds together the particles of soil, sand or loose rock and provides a moderate increase in shear strength. Stabilized soils below the water table are believed to retain their properties permanently.

AM-9 has been successfully used to seal off the flow of underground water into oil wells, drill holes, tunnels, coffer dams, sewer pipe joints, caissons and open excavations, and to seal underground curtain walls in and around dams and dikes. It is particularly effective for solidifying weak, granular soil masses during tunneling operations, the sinking of caissons, and in many types of shafts and excavations. However, applications in which it is desired to increase the load bearing characteristics of soils are not recommended at this time.

The equipment for applying the chemical generally consists of two positive displacement pumps designed to handle AM-9 solutions and catalyst solutions separately. The pumps should have variable speed controls so that the solution volumes can be changed at will to vary gel time and concentration. The two solutions are brought together and mixed at or near the injection point in a suitable fitting.

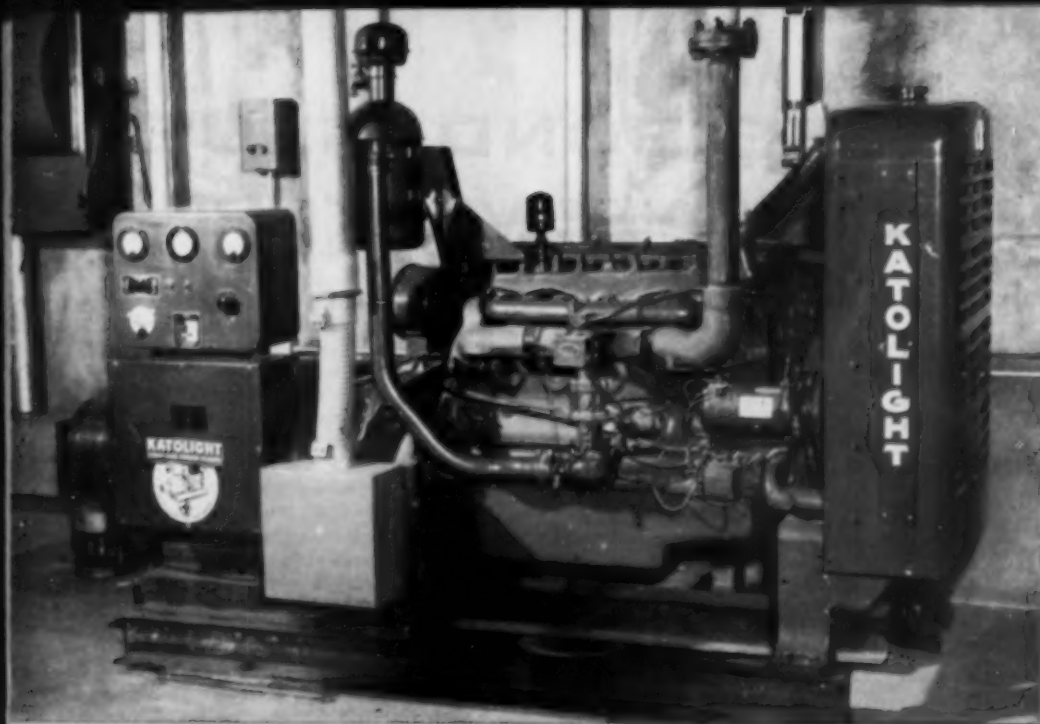
AM-9 in both powder and solution forms contains acrylamide, a toxic chemical, and prolonged or repeated exposure must be avoided. However, there are no health hazards associated with field applications when used as directed.

The chemical may also be mixed with cement, bentonite, sawdust, salts and thickening agents to modify the properties of the solutions and the resulting gels.

AM-9 was developed under the direction of Dr. Abbott M. Swift, supervisor of special projects in the market development department of Cyanamid's Commercial Development Division. His work was begun while he was a group leader at the company's Stamford, Conn., research laboratories.

Increased Research Facilities at Ohio State

A new \$180,000 Water Resources Center, scheduled for completion in May, 1960, at The Ohio State University will about triple space available on the campus for chemical and biological research in water, sewage, and industrial wastes. The new facility, now under construction, has been made possible from a grant by the National Institutes of Health and a State of Ohio appropriation.



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**—M. Seward,
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CITY BACKS BOND ISSUE BY REAL ESTATE VENTURE

C. E. WRIGHT

ONE of the most unusual transactions between a municipal government and a private development company has taken place at West Palm Beach, Fla., with the sale of 4200 acres of city-owned property to Perini-Westward Developers, Inc., for construction of "a city within a city."

Some years ago the City of West Palm Beach, in order to get backing for an issue of revenue bonds, purchased the privately-owned West Palm Beach Water Co., and then pledged the water receipts in the sale of the bonds. The water company owned 4200 acres of land west of the city, which it used as a catchment area for the public water supply before supply improvements were made by the municipal government.

For many years the growth of West Palm Beach has been extending northward to the city line of Riviera Beach and southward to the city line of Lake Worth. Thus the continued growth of the city was restricted on three sides. The only way it could expand was westward. This situation brought about negotiations for the sale of the water supply property to a land developer who would build enough houses to keep pace with the city growth, which has necessitated about 2400 new homes a year.

Perini-Westward Developers, Inc., headed by Lou Perini, nationally known contractor and owner of the Milwaukee Braves baseball team, paid the city \$4,352,503 for the property and entered into an agreement with the city to develop it in compliance with plans and specifications prepared by Brockway, Weber & Brockway Engineers, Inc. of West Palm Beach, the city's consulting engineers. Later the Perini company bought additional abutting land from private owners to bring its total to more than 5,000 acres.

Preparing the Property

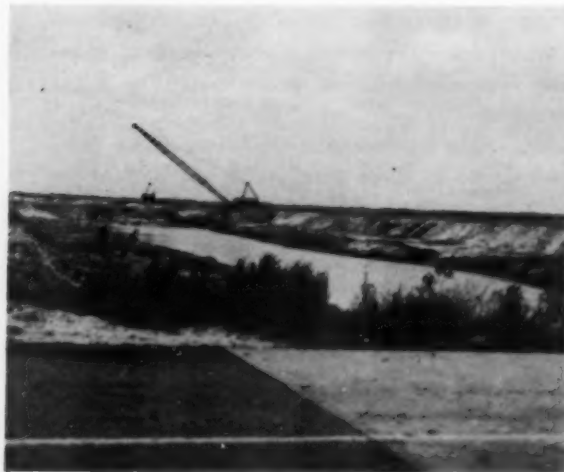
A part of the deal with the city required that the developer set aside sufficient acreage for a low-income housing area. Thus far about 200 homes have been completed in this section at the northern end of the building development. There is room for 1,400 homes in this area alone.

Preparing the property for a huge housing development was a monumental task. Perini-Westward spent about \$9,000,000 before any homes were started. In its earliest stages, construction involved moving some 16,000,000 cu. yds. of earth, mostly sand and muck. The black, soft, organic Everglades muck required stripping and replacement with suitable fill to prevent excessive settling of the structures. A large acreage has been raised to an elevation expected to prevent flooding

in compliance with requirements of the engineers. Fill material for the project has been obtained by dredging two city water reservoirs having a surface area of approximately 1,000 acres. Raw water storage was increased from about 2,000 acre feet to approximately 20,000 acre feet, and these reservoirs are being fed through a new gravity feed canal constructed into the Westward expansion area from a new water catchment area west of the city.

There was also an extensive program which involved slum clearance on a portion of the property; construction of new highways, flood control, storm sewers, drainage culverts and canals. The latter will direct excess water from the city to the newly constructed Canal C-17 of the Central and Southern Florida Flood Control District. Minimum grade elevations prescribed for the program are well above 20-year storm intensity design periods, assuring proper gravity flow of all storm water to the Atlantic Ocean through Canal C-17.

In addition to providing complete storm drainage and improved public water supply, the construction of Westward Expansion includes complete water distribution and sewage collection facilities. Water supply and sewage treatment will be handled by the existing municipal plants of West Palm Beach. Water into the Westward Expansion area



● PROJECT involved moving some 16 million cubic yards of earth. Dragline shown here is dredging water catchment basin.



● SLUM clearance project was combined with the construction program to provide this development of modern homes.

will be delivered through a 24-in. main constructed from the plant pumping station. Two 1,000,000-gal. water storage basins and repump facilities are proposed for construction within the expansion area. Gravity sewage collection facilities feed into a 16-mgd capacity master pumping station for discharge into the municipal sewage treatment plant.

Westward Expansion is also providing the City of West Palm Beach with a solution to its increasingly complex traffic problem by providing the nucleus of an integrated local highway improvement program. Advance planning of present and future traffic requirements is an important aspect of the project. U.S. Highway 1, which extends through the center of downtown West Palm Beach, has long been overloaded as an interstate highway. In addition, the city has its own local traffic problems apart from the through traffic.

Construction by Westward Expansion will provide major north-south and east-west thoroughfares and limited access highways. State Road 9, a north-south highway paralleling the Sunshine State Parkway, the toll turnpike, will undergo major reconstruction between West Palm Beach and Miami, removing some of the traffic from U.S. 1. There will be in addition two parallel north-south thoroughfares to handle fast intercity traffic. Crossing Westward Expansion from west to east will be a multilane divided thoroughfare connecting the westerly limits of the city with the coast by means of a new bridge across Lake Worth and the Intracoastal Waterway. Additional east-west multilane thoroughfares will be provided to strengthen connections between U.S. 1 and Westward Expansion. Within the property itself are more than 40 east-west roads to serve residents of the area.

In the overall development of Westward Expansion all phases of city planning were encountered. Completion of this project will provide for West Palm Beach a new and well integrated addition.

Industry By-Products Used For Highway Construction

Research at the Texas Transportation Institute has resulted in uses for by-products of the rock asphalt mining industry, according to Bob M. Galloway, Institute Research Engineer. This major by-product of Texas industry is now accumulated

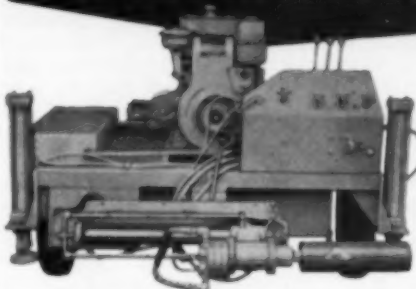
in the hundreds of thousands of tons.

The rock asphalt mining by-product consists of the "fines" resulting from the screening process where rock asphalt is being mined, crushed and prepared for use in paving mixes. The new use is in hot-mix operations, as additions to other aggregates of marginal quality. The material is said to be particularly useful in mixes containing siliceous aggregates, which are relatively smooth rocks such as in pea gravel. The natural asphalt in the fines helps to act as a liquefying and stabilizing agent, improving the

durability of the mix, and reducing the susceptibility of the mix to action of water.

Surfacing mixtures using the rock asphalt fines have been put down on two residential streets in College Station. This paving is standing up under traffic in good shape. Another use was on a commercial contract job on Interstate Highway 35 near Laredo. This is a highway carrying eight traffic lanes, and the hot mix utilizing the rock fines extends for several miles. Use of the material is also foreseen for slurry seals, and for patching old road surfaces.

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● **STEPS** in bridge roadway repair, left to right: Sand is blended into adhesive compound; one worker puts mortar on the road while the other works screed to level material; and worker puts finishing touches on the repaired section.

Photos courtesy Thibol Chemical Corp.

BRIDGE REPAIR USES SPECIAL EPOXY MORTAR

HOW TO REPAIR concrete roadways quickly yet with watertight permanence, was demonstrated recently by a remedial project on the Richmond—San Rafael Bridge in California. A dip existed in the bridge roadway; $\frac{3}{4}$ inch deep and 10 feet wide, it was 36 feet long and extended across several lanes.

Conventional repair techniques would have required removal of base concrete until the reinforcement steel was bared. Then the new concrete would have been laid and smoothed to the desired level to remove the dip.

The engineers considered accomplishing the repair with polysulfide

modified epoxy adhesive and a new concrete overlay. This would have required merely sandblasting the area to be covered, applying the adhesive and laying the thin concrete overlay. From past experience the engineers felt that such a technique would cut the cost and time, and at the same time provide a permanent overlay for the roadway. But this too had a drawback. The time required for the concrete to set and become sufficiently strong would still tie up traffic longer than was desirable.



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Brown & Blakeney, Fort Worth contractors use their Tampo vibratory roller on their state highway project near Arlington.



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BOX 4248, STATION A ● SAN ANTONIO 7, TEXAS

Because only a 3/4-inch overlay was required to fill the dip, the engineers decided to employ a polysulfide modified epoxy mortar—a mixture of adhesive and aggregate. By so doing, the time the lanes had to be closed to traffic would be held down to only a few hours. In other words, the repair could be sandwiched in between the hours of heavy commuter traffic.

Sandblasting was required to clean off loose particles and oil film in order to give the mortar a good surface to which it could bond. An adhesive composition, developed by the Division of Highways, consisting of liquid epoxy resin, liquid polysulfide polymer and curing agent was used. After these ingredients were properly mixed, enough white filler was combined to give the finished mortar a concrete-like appearance to match the rest of the roadway. Then the adhesive was poured into a mortar box and combined with aggregate in a one to fifteen ratio. Then the mortar was applied.

Application of the mortar was made in a manner similar to applying concrete. As the void was filled with shovels of mortar, a screed was worked over the material to smooth the surface. Since little solvent is used in the compound, shrinkage is not a problem. Sand was sprinkled over the application, and a wood float was used to smooth the material.

Pot life of this chemically cured mortar is less than an hour. Thus the mixing was done in batches and applied in sections about two feet by ten. Pot life could have been extended, but it was not deemed necessary in this application.

Curing time for such a mortar varies with the temperature; time will be reduced as the temperature is increased to 250°F. At 80°F the mortar is sufficiently hard to take traffic in about twelve hours. By applying heat the curing time can be reduced to one hour. On the job engineers heated the applied mortar for about 30 minutes and left the lanes closed overnight. Propane burners were used to apply the heat. Actually the road could then have been opened within four hours without damage to the resurfaced area.

• • •

Pedestrian Fatalities and Injuries

There were 2,910 pedestrians killed and 66,030 injured on U. S. roads and streets last year, according to insurance company records.

PUBLIC WORKS for June, 1960



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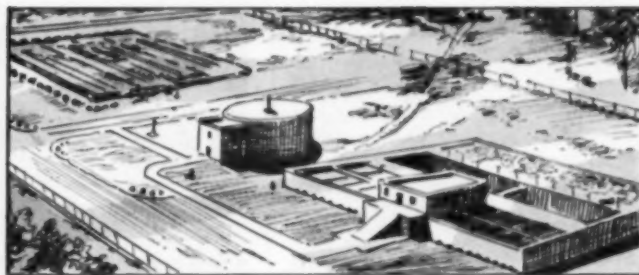


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THE SEWERAGE AND REFUSE DIGEST



Prepared by **ALVIN R. JACOBSON, Ph.D**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Spray Disposal of Domestic Sewage

Spray irrigation of domestic sewage has been initiated in the U. S. during the last two or three years; however, this development has been almost exclusively in the Puget Sound region of the State of Washington. This action was prompted by the orders 3 years ago from the Washington State Health Department and the Washington State Pollution Control Commission prohibiting the disposal of sewage wastes, treated or untreated, into Lake Washington. Since that time spray field installations have been completed to serve five residential developments. In addition, installations are being designed to serve the U. S. Army Nike missile sites in the area. Several factors affect spray field operations including: The type of crop; the permeability of the surface and subsurface soils; the slope of the surface; the rate of application; the length of time the waste is to be applied, the chemical characteristics of the waste; the chemical composition of the soils; and, of course, the quantity of waste to be applied. A reasonably good vegetation cover can be expected to survive and even thrive where adequate consideration has been given to the design of the spray fields and to proper control of the quantity and quality of the sewage effluent. Based upon experience in the Puget Sound area, the author makes several general recommendations as to the type of site, maintenance of the sites and the types of plants used as vegetation cover. Full advantage should be taken of all data and experience available if and when it is desirable to initiate steps for the disposal of domestic sewage by spray irrigation.

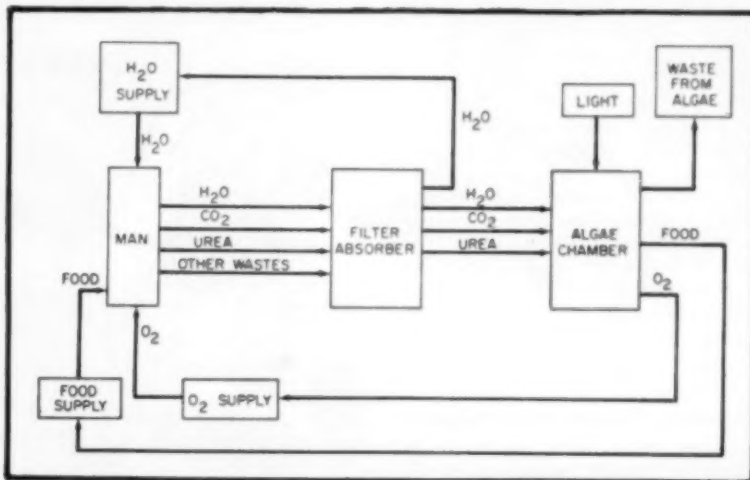
"Spray Disposal of Domestic

Waste." By William J. Chase, Partner, Hill & Ingman, Consulting Engineers, Seattle, Washington. *PUBLIC WORKS*, May, 1960.

Sanitation In Space

In the near future man will leave the earth's atmosphere on his first flight in space. It is also contemplated within the foreseeable future that man will establish vehicles in space and set up colonies on other planets. However, in these ventures he will encounter a wide variety of environments which are not conducive to his survival without adequate control. He must use his skill, experience and ingenuity to transform the conditions of space and of other worlds into environments where it is possible not only to survive but to exist comfortably. The one important distinction between the environments on the earth and in space is that the former is basically compatible while the latter is hostile to man. There-

fore, it is necessary in the first place to provide a friendly environment and secondly to protect against contamination. Man's initial venture into space will be in a tiny space capsule, at first for only a few hours, but later for periods of days, weeks, or more. Permanent space stations and visits to and colonization of other worlds will follow at a later date. Important differences between the problems of sanitation in space and in modern cities are defined first by the physical environment and second by the state of missile engineering as reflected in the payloads which can be carried on space missions. Sanitation equipment to be used in space must be designed to operate under conditions of weightlessness and in the total absence of any external atmosphere. In addition, limitations of space and weight cannot be overemphasized. All necessary materials must be carried in the capsule from the surface of the earth as a part of the strictly limited payload. Keeping in



Courtesy Journal Water Pollution Control Federation

● SPACE sanitation will require reuses of the essentials for supporting life.

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PUBLIC WORKS for June, 1960

mind the four controlling conditions of weightlessness, absence of atmosphere, minimum volume and weight and the lack of external supply sources, the three possible solutions to the problem of sanitation are: 1) The open cycle; 2) the semi-open cycle; and 3) the closed cycle system. The open cycle system includes the storage of food, water and oxygen with no reuse of waste products; it will be adequate for the first vehicles to be placed in space for periods of only a few hours duration. For flights of longer duration it is possible that semi-open cycle systems might be developed in which man's waste products may be chemically absorbed and the chemical absorbents may be reprocessed and reused. The major inadequacy of all chemical systems is their failure to provide the oxygen, water or sustenance that is so vitally needed. In the closed cycle system all waste products—solid, liquid, and gaseous—are used to provide fresh supplies needed by man. For example, the waste solutions may be pumped into a tank of algae where, by photosynthesis, the carbon dioxide is converted to oxygen. In addition, the algae may be a nourishing, though not palatable, source of food.

"Sanitation In Space." By Laurel van der Wall, Space Technology Laboratories, Inc., Los Angeles, Calif. *Journal Water Pollution Control Federation*, April, 1960.

London's Treatment Plant

A century old British sewage treatment plant has recently been remodeled and enlarged at a cost of \$27 million to provide complete treatment to an average daily dry weather sewage flow of 178 mgd. The plant serves a total area of 112 square miles with a population of nearly three millions. Five 9-ft. by 9-ft. horse-shoe shaped brick sewers convey the sewage and storm water to the plant where it continues by gravity through the plant with the treated effluent discharging into the River Thames. Six detritus pits, each 130 ft. long, provide for sand and grit removal before the sewage flows to the new primary sedimentation tanks preceded by coarse and medium screens. The screenings are mechanically removed, passed through disintegrators, and then returned to the sewage upstream of the screens. After screening, the sewage is given pre-aeration treatment for about 20 minutes in the twin supply channels

leading to the sedimentation tanks. After removal of about 70 percent of the suspended solids in the sedimentation tanks, the effluent passes over outlet weirs to an open channel connected to the two activated sludge plants for secondary treatment. Activated sludge plant No. 1, a partial treatment plant, is a surface aeration plant with separate reaeration by diffused air. Activated sludge plant No. 2 is a diffused air plant. The effluent from the two activated sludge plants flows into the final settling tanks before discharge into the River Thames. The sludge (including surplus activated sludge) from the primary sedimentation tanks and the sedimentation channels is pumped to dewatering tanks. The thickened sludge is pumped simultaneously to the primary digestion tanks through heat exchangers where heat is recovered from the outgoing sludge and transferred to the incoming sludge. After approximately 10 days' digestion the sludge gravitates to four open secondary tanks for a further period of digestion to assist in the dewatering of the sludge. The reduced volume of sludge is disposed of at sea some 55 miles from the sewage works. The sludge gas is normally used as a fuel, but diesel oil or fuel

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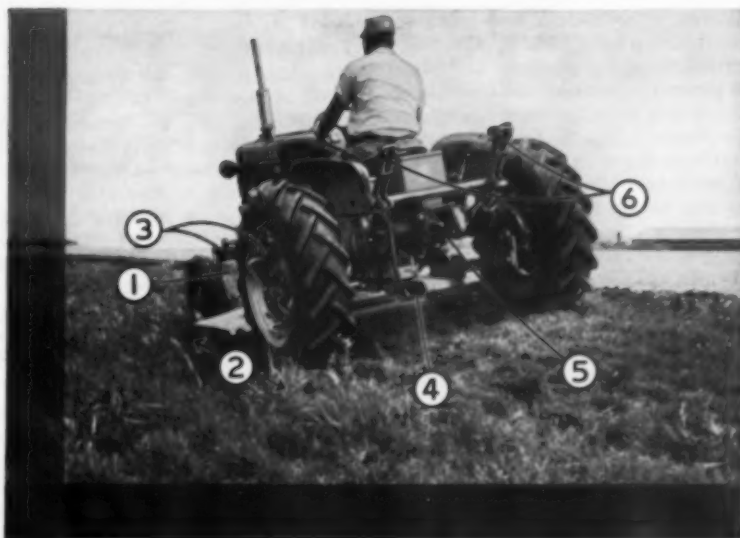
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oil can be used as an alternative fuel. Six electrostatic precipitators are installed to ensure a very clean air supply for the diffusers and the gas turbines.

"Sewage Works Expansion Costing Over \$27 Million." By William A. Heath, London, England. *Water & Sewage Works*, April, 1960.

Joint Sanitation Programs

A comprehensive vector control project, encouraged and supported by the entire community is bringing about more than an inconsequential "face lifting" in Jackson, Tenn. This program which is jointly sponsored by the City Commission, the Jackson-Madison County Health Department, the Tennessee Department of Public Health and the U. S. Public Health Service has substantially raised the overall level of community sanitation and eliminated some serious health problems. To ascertain the existing sanitary conditions in the community, an environmental sanitation survey was made of all premises. The city was divided into 11 socio-economic sections permitting a more scientific evaluation of the results of the survey. The results of the survey revealed that only 36 percent of the households were using approved metal garbage containers, more than one-half of the city's blocks provided harborage for rats and standing water was found in about one-third of the premises providing ideal sites for mosquito development. Other major problems, such as unsanitary animal shelters, outdoor toilets, and industrial wastes complicated the situation. The results indicated that a stringent garbage ordinance should be adopted, and increased collection service was necessary to help break up the fly and mosquito breeding cycles. A new ordinance was passed and there was inaugurated an extensive overhaul of the existing garbage collection routes. The city initiated twice-a-week service to all residences and daily pick-up in the business district without the necessity for additional personnel or equipment. An intensive control program helped the mosquito problem. A three-man larviciding crew sprayed all actual and potential breeding sites with a 1% DDT fuel oil mixture by means of knapsack and hand sprayers and a Jeep-mounted Buffalo Turbine sprayer-duster. New ordinances were also adopted to control animals and fowl in and about residences. A recent re-survey showed that 87



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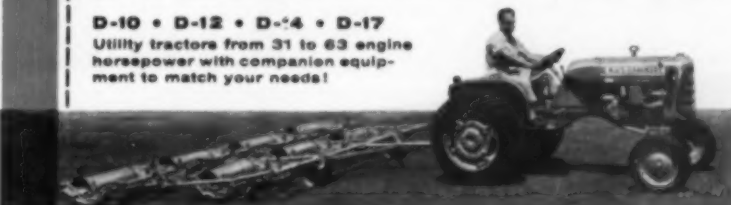
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percent of residences and business establishments have approved refuse-storage containers and that 96 percent of animal and fowl shelters within the city limits have been eliminated. This indicates considerable progress in the improvement of sanitation and the elimination of serious health problems.

"Jointly Sponsored Sanitation Program." By R. M. Neudecker, Formerly Director, Jackson-Madison County Health Dept., at present Director, West Tennessee Dept. of Health. *The American City*, April, 1960.

Joint Treatment

In March 1960 the largest activated sludge plant (21 mgd) ever constructed for the treatment of pulp and paper mill wastes was placed in operation at Westernport, Md. Not only is this size exceptional, but it is noteworthy from another standpoint, in that it is designed to handle not only the wastes from the vast Luke, Md., plant of the West Virginia Pulp and Paper Co., but also sewage from three nearby communities—Luke and Westernport, Md., and Pied-

mont, W. Va. The new treatment plant is owned by the Upper Potomac River Commission—a state-created agency originally established in 1935—which was given additional powers by the Maryland General Assembly to include the new assignment of operating this wastes treatment plant. This new activated sludge treatment plant will have a design capacity of approximately 21 mgd and it is estimated that 95 percent of the wastes treated at the plant will be contributed by the pulp and paper mill and the other 5 percent will come from the surrounding municipalities. The characteristics of the wastes are estimated to be 263 ppm of 5-day BOD and 290 ppm of suspended solids, with maximum values of 435 ppm and 800 ppm, respectively. The plant consists of: One primary clarifier, four aeration tanks providing 6.5 hours aeration, with 40 percent return activated sludge and an aeration solids concentration of 3,000 ppm, two final clarifiers, one sludge thickener, and one vacuum filter with the usual accessories for conditioning and handling sludge. Turbine aerators are used in place of the conventional air diffusers, requiring a lesser amount of air. Several photographs and a flow diagram add interest to this article on this plant which was specifically designed and constructed for the joint treatment of sewage and industrial wastes on a cooperative basis.

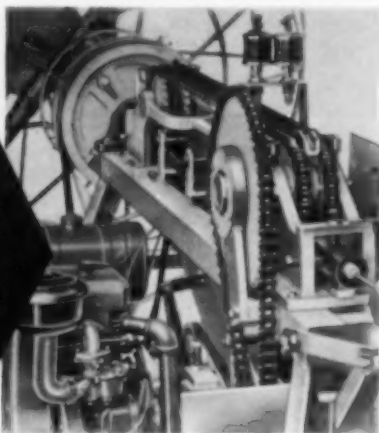
"Largest Activated Sludge Plant For Pulp and Paper Wastes Will Treat Sewage From Three Towns." *Wastes Engineering*, April, 1960.

Continuous BOD Recorder

Few sanitary engineers and scientists will raise objection to the contention that the BOD determination is one of the most useful tools in the field of sewage and industrial waste treatment. Many methods are available, although usually quite laborious, by which a large number of points of the BOD curve can be obtained. Also manometric techniques have been used to obtain even larger numbers of points on the curve. Some changes which would improve the standard 5-day bottle dilution test are: A shorter test period; greater precision and accuracy; continuous record of test; results more representative of the whole; less influence of method and procedure on results; and results expressed as an electrical signal for automation. The

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WHICH GRIT COLLECTOR

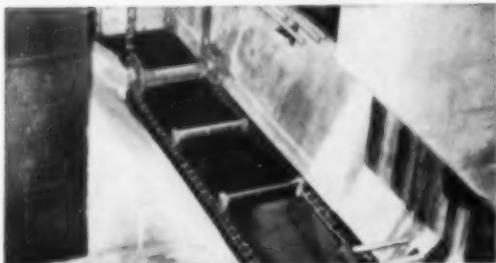
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STRAIGHTLINE GRIT COLLECTORS provide an easy method of collecting settled grit and inert solids without draining the grit chamber. These solids are dewatered and removed from the chamber by flight conveyors, screw conveyors, or buckets attached directly to the collectors. Shown is a Link-Belt Type B double-strand installation.

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author proposes a new continuous recording electrical method which embodies a portion of each of the above desirable improvements. In this method, digestion takes place in a closed system. As the oxygen is used and the carbon dioxide given off is removed from the system chemically, there is a pressure drop in the digester. This rate of pressure drop is converted to an electrical current by means of a transducer and power supply. An electrolysis cell is connected to the pressure-controlled power supply. In this cell oxygen is given off at the anode and

made available to replace that used in the digester. Measurement of the electrical energy developed by the pressure drop will give a measure of the oxygen demand which is recorded on a strip chart. The author provides a detailed description of the apparatus, together with photographs and the results of several tests performed in the laboratory. The application of the method would seem to have the potential of establishing as fact many of the contentions regarding the BOD curve.

"Continuous Recording BOD Determination." By J. W. Clark, Prof.,

Civil Engineering Dept., New Mexico State University. *Water & Sewage Works*, April, 1960.

Other Articles

"Automatic pH Control of Finished Waters." The device described is a "do it yourself" approach for maintaining a desired pH value within plus or minus 0.05 unit in treated water. By W. Bruce Murray, Civil Engr. Assoc., Water Dept., Long Beach, Calif. *Water & Sewage Works*, April, 1960.

"Kansas City Plans Interception, Pumping and Treatment Program." A \$75-million master project, geared to tie in with regional facilities, would handle city's sewage and industrial wastes. By Ray E. Lawrence, Paul D. Haney and John Schmidt, Black & Veatch, Consulting Engineers. *Wastes Engineering*, April, 1960.

"Only One Answer—Incineration." Study finds dump sites running out in Wisconsin's Milwaukee County; advances incineration as the only long-range solution for county-wide refuse disposal. By C. D. Goff, Ass't. Prof. of Political Science, University of Wisconsin, Milwaukee, Wisc. *The American City*, April, 1960.

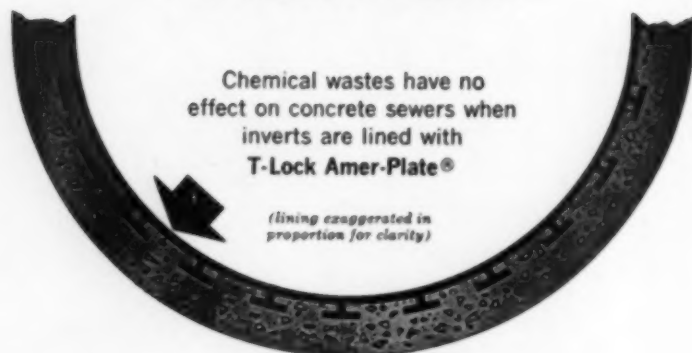
"The Completely-Mixed Activated Sludge Process." How this process is now being applied both for domestic sewage and industrial waste treatment plants. By A. A. Kalinske, Vice President and Technical Director, Infilco Inc., Tucson, Arizona. *Public Works*, May, 1960.

"Municipal Refuse Practices in Oklahoma." Results of a questionnaire sent to 292 cities and towns. By LeRoy K. Rachels, Entomologist, Division of Sanitary Engineering, Oklahoma State Dept. of Health. *Public Works*, May, 1960.

"Amino Acids In Sewage Results." A comparative study of the amino acid composition of activated sludge and other sludges, the rate of removal by activated sludge and in the natural process of purification of flowing sewage at Bangalore. By P.V.R. Subrahmanyam, C. Anandeswara Sastry, A.V.S. Prabhakara Rao, and S. C. Pillai, Research Scholars, and lecturer in Sanitation Biochemistry, respectively, Department of Biochemistry, Indian Institute of Science, Bangalore, India. *Journal Water Pollution Control Federation*, April, 1960.

"Forecasting Heat Loss In Ponds and Streams." A method based on conventional stream gaging data and weather records. By C. J. Velz and J. J. Gannon, Professor of Public Health Engineering and Chairman of the Department; and Associate Professor of Public Health Engineering, Department of Environmental Health, School of Public Health, University of Michigan, Ann Arbor. *Journal Water Pollution Control Federation*, April, 1960.

How to Protect Concrete Sewers from Chemical Wastes



T-Lock Amer-Plate is a high polymer PVC sheet, easily cast into pipes, tunnels and structures to form a partial or complete 360° protective lining. Used in inverts, it permanently protects concrete from corrosive chemical effluents. In arch areas, it positively stops oxidized H_2S corrosion. T-Lock is also highly abrasion resistant; impartial tests show that it abrades at only 1/70th the rate of concrete.

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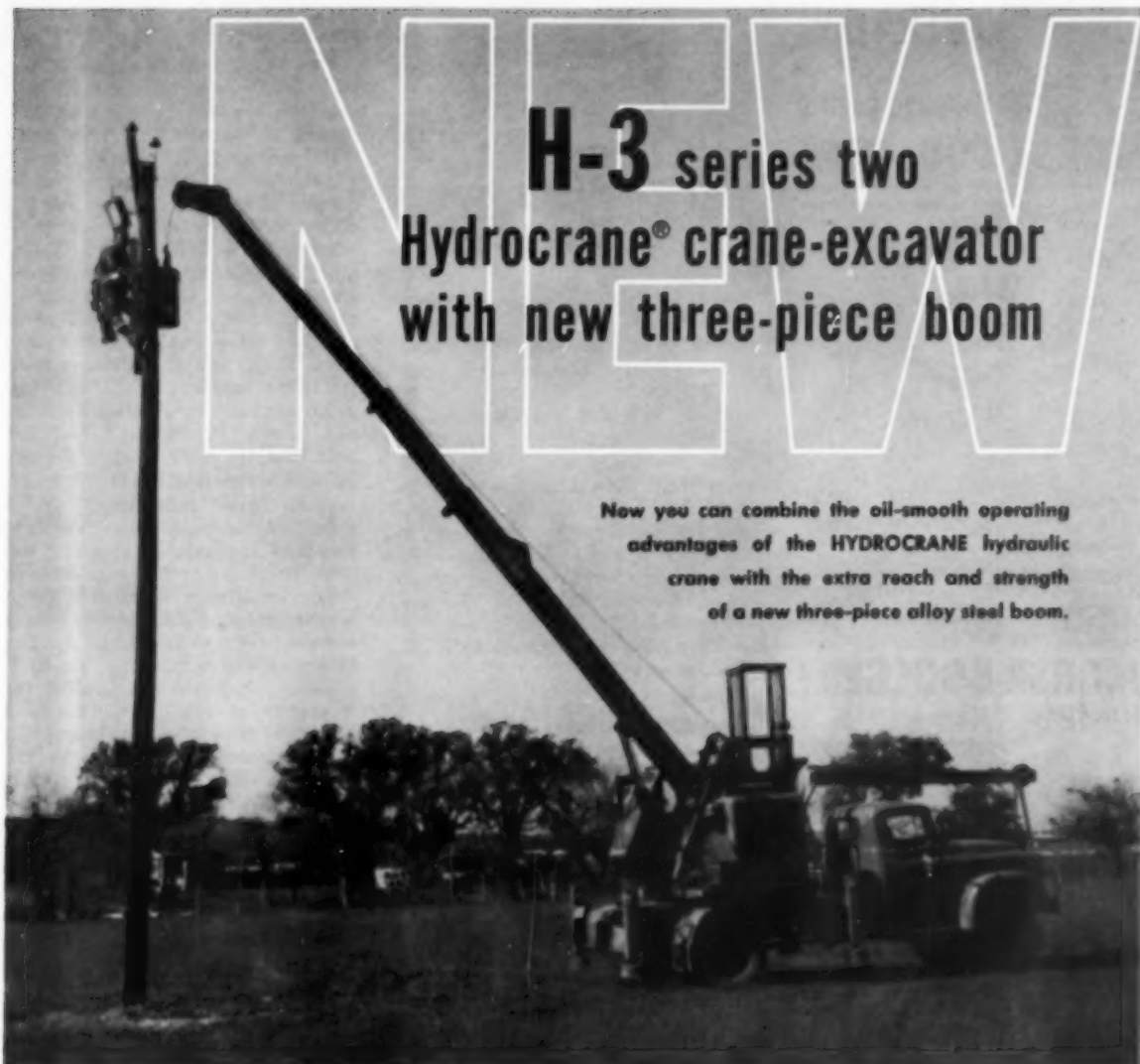
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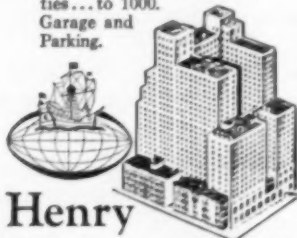
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This publication lists the Federal
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find the one that may best utilize
a special competence. Scientific
fields are listed and the agencies
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these fields. Then the Federal agencies
are listed with information on
the types of research of each. Finally,
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to apply. Social Legislation Information
Service, Inc., 1346 Connecticut
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Document 14; \$1.

"PRICELESS WATER" PROMOTION FOLDER

General purposes of the PRICE-
LESS WATER campaign of the
American Water Works Association
and an outline of the several steps
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take to further this campaign within
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NEW YORK CITY PUBLIC WORKS

To see the complexities of a pub-
lic works program in a big city, read
the 64-page annual report of the
Department of Public Works of New
York City of which F. H. Zurmuhlen
is Commissioner. Included are sec-
tions on the capital budget program;
building design and construction;
pollution control; bridge design and
construction; and building manage-
ment, administration and services.
There is also considerable engineer-
ing data. Of particular interest are
the descriptions, operational results
and operation and maintenance costs
for New York sewage treatment
plants—12 new and 2 old.

BASIC ESTIMATING FOR PRODUCTION COSTS

This 76-page book is one of the
very fine and useful texts for any
engineer engaged in planning, de-
signing or constructing. It is diffi-
cult here to do full justice to the
quality of the information, but a
resume of section headings will in-
dicate the scope of the data pre-
sented. Under "Equipment Selection"
are applications for bulldozers
and bullgraders and uses in general
excavation, with pusher-tractors, in
pipe line work and in forest indus-
tries. There is also a discussion of
tracks vs. rubber. More than 30
pages are then devoted to "Estimat-
ing Hourly Production." Included
are: Basic formula, efficiency hour,
in-bank correction factors, machine
capacity, cycle time, travel cycle-
time factors, fixed cycle-time fac-
tors and methods of applying the
basic formulas to the job. A third
section deals with "Estimating Fixed
and Operating Costs"; and a fourth
section covers estimated production
under various conditions. Section V
contains reference data useful for
a variety of conditions. This is a
book that most of our engineers will
find very handy. Illustrations are
fine; examples are worked out. It
is produced by the Construction
Equipment Division, International
Harvester Co., 180 No. Michigan
Ave., Chicago 1, Ill. The price is
indicated as \$5, and it is worth it.
If in doubt, ask your local IHC
dealer to let you look at a copy.

WEST COVINA CALIFORNIA

Published for the City of West
Covina, Calif., by the local Chamber
of Commerce, this exceedingly at-
tractive booklet shows the growth
from orange groves in 1940 to a
city of 50,000 today. There is much
of interest also on the municipal
services provided for the citizens.

HIGHWAY PROGRESS FOR 1959

This is the annual report of the
Bureau of Public Roads for fiscal
year 1959. As usual, it is an excel-
lent job. There are 99 pages, of
which 35 are tabular material. An
especially interesting section is that
devoted to the development of new
practices. These include better utili-
zation of electronic equipment; the
development of new equipment co-
operatively with manufacturers and
contractors; uses of radio commu-
nication; and experimental projects.
40 cents from Superintendent of
Documents, Government Printing
Office, Washington 25, D. C.

CONSULTING ENGINEERS ON FEDERAL PROJECTS

A survey report entitled "The Role of the Consulting Engineer in Federal Public Works Projects" is now available from the National Society of Professional Engineers, 2029 K Street, N. W., Washington 6, D. C. The report, prepared by the National Society's Functional Section for Consulting Engineers in Private Practice, surveyed 1,464 engineering service contracts with 17 different government agencies and bureaus. The report shows that average fees charged by private engineering consultants on government projects are considerably lower than widely publicized cost figures. On total construction costs of \$4,325,010,612, the report lists engineering design contract fees as totaling \$127,694,354, resulting in a computed average of 2.95 percent for design. Copies of the 144-page report may be obtained from the NSPE for \$3.

A CITY REPORTS ON ITS FINANCIAL CRISIS

An attractive booklet, presented in the interest of good city government by the City of Jackson, Mississippi, highlights the financial problems created by growing urban populations which require expanded municipal service. Entitled "Crisis in Our Cities," this 16-page booklet lists major improvements needed and suggests an increased sales tax as the most realistic source for additional revenues.

ENGINEERING IN ACTION

This is a record of Allis-Chalmers progress and achievements in 1959. There are eleven chapters describing advances in generation, transmission and distribution of power; and also a report on latest research findings on fuel cell advances and atomic energy developments. Ask for Bulletin 25R9529, Allis-Chalmers Mfg. Co., Industries Group, Milwaukee 1, Wis.

CIVIC CENTER FOR MEMPHIS

The final report of three on the design of the proposed Civic Center for Memphis, Tenn., has been issued by the League of Memphis Architects, Inc. This illustrates in detail the general site plan and the proposed schedule of development. The three reports represent an outstanding piece of work. It was sent us by Thomas F. Faires, President of the League of Memphis Architects, Inc., 1027 Falls Building, Memphis, Tenn.



Cleveland J-40 digs shale and rock 3-5 feet deep for highway drainage

THE JOB: 20 miles of drainage trenching in both inner and outer shoulders of five miles of dual highway for the relocation of U.S. Route 25 near Middletown, Ohio.

CONDITIONS: trench to be cut to grade, 18 inches wide, 3 or 5 feet deep depending on inner or outer shoulder, through very densely compacted shale and rocky material, further densified because much of the grade carried hauling equipment all through a winter, spring and summer.

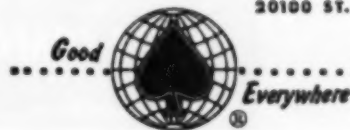
PERFORMANCE: despite need to replace worn bucket teeth more frequently than usual because of the tough digging, the Cleveland J-40 dug the trench to accurate grade at the rate of 1,800 to 2,000 feet per 9 hour day.

J-40 FEATURES:

- Stability—on wide-spaced crawlers, 1000-hour-lubricated
- 100% control of every operation at the operator's seat
- V conveyor for faster, higher, more efficient spoil discharge
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- Automatic conveyor shifting from side to side
- Over 30 non-slipping digging speeds
- Digs trench 17½ to 30 inches wide, down to 5½ feet deep.

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EFFICIENT TOLL COLLECTION FOR A PARKING GARAGE

A NEW 703-car underground parking garage, where shoppers can park their cars for 10 cents a half-hour and have their fees computed accurately and automatically as they leave, has been opened at the Brooklyn, N. Y., Civic Center.

The garage is intended primarily for those who wish to shop or do business in the stores or offices of the center, and is not for employees or other personnel. Basic parking rates are set at 10 cents for a half-hour between 7 am and 7 pm, with a maximum charge of \$1.50 for that period. On Saturday and Sunday, the rates are also 10 cents for a half-hour, but the maximum rate is 50 cents for 12 hours; parking for 24 hours costs \$2. These are the starting rates. If studies over the first six months of operation show that all-day parkers are filling the garage, the rate structure will be



● **TOLL COLLECTION** and revenue control system built by Teller Cooper Division speeds traffic flow at new garage. Ticket issue and fee computation are automatic.

altered to favor short-time parking to aid people using local stores, theaters, and other business establishments.

The Teller Cooper toll collection and revenue control system speeds traffic flow and makes the most efficient use of parking space. It provides for automatic ticket issue on entrance and automatic fee compu-

tation on exit. All transactions are recorded in detail automatically, including identification of the attendant on duty.

As a car enters the garage, a red light signals the driver to stop at the ticket issuing machine. Imbedded in the roadway is a car detector treadle. As the front wheels of the vehicle roll over the treadle, im-

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(Visualize the RADAX Broom Coil as a big nut and your broom core as a threaded bolt. The RADAX unit screws on like putting a nut on a bolt.)
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pulses from the treadle cause the ticket issuing machine to print date and time on a prenumbered parking ticket. Simultaneously, date and time are punched into the ticket for subsequent sensing by an automatic computer. The machine then brings the ticket forward to be picked up by the patron. A remote printing recorder registers the transaction in the manager's office.

As the driver picks up his ticket, the traffic light in the lane turns green. When the rear wheels of the car cross the treadle, the light returns to red. Should the rear wheels cross the treadle while the traffic light is still red, however, an alarm sounds indicating the driver's failure to take his ticket.

On leaving the parking garage, the driver pulls up to the cashier's booth and hands the attendant his ticket. The front wheels of the vehicle actuate another car detector treadle preparing the parking fee computer and remote printing recorder for action.

The attendant inserts the ticket into the parking fee computer, and the computer reads the time on the ticket by sensing the position of the punched holes and automatically computes the parking fee. The amount is flashed on a fee indicator, and a bell rings to call the driver's attention to the amount due. Once validated, the ticket cannot be used again.

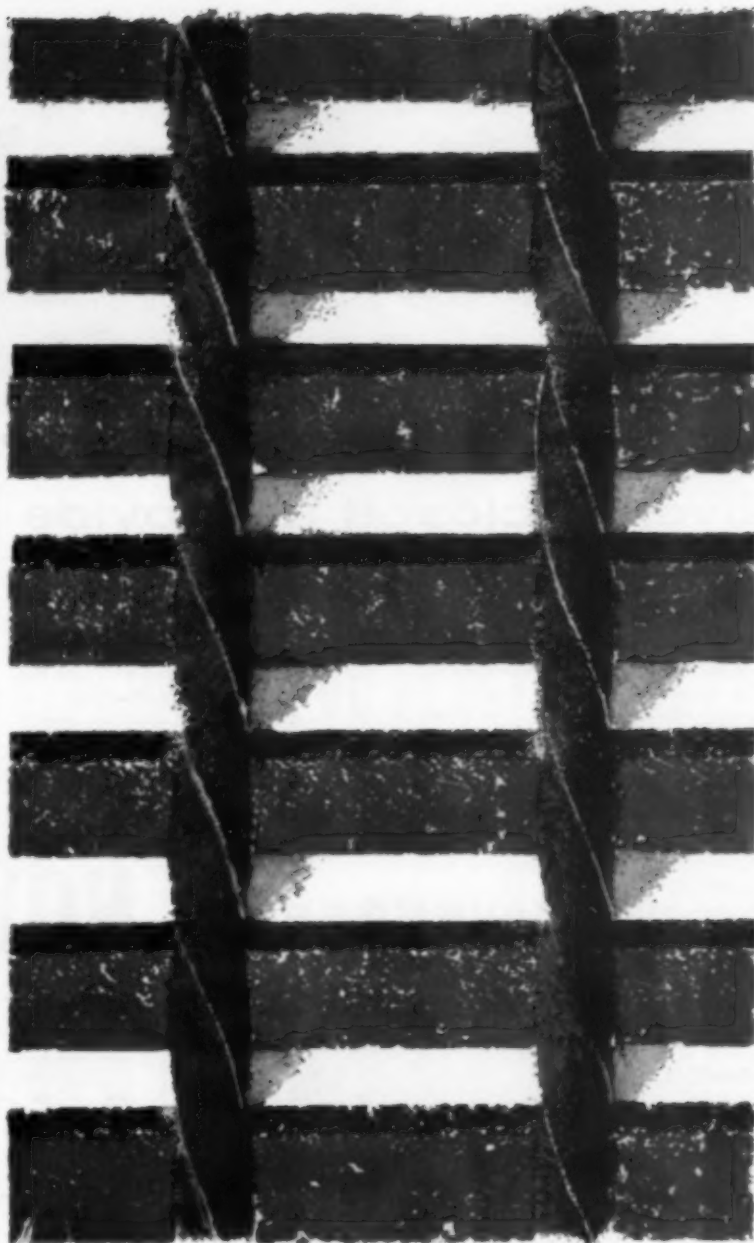
Following payment of the parking fee, the driver exits. As the rear wheels of the vehicle pass over the car detector treadle, the treadle signals the remote printing recorder that the transaction is completed.

Under lock and key in the manager's office, the remote recorder makes a completed record of vehicles in, vehicles out, time, receipts and attendant identification. Identification is established by use of a special key identifier which must be inserted in order to actuate the system as the attendant comes on duty. In this way, the recorder registers the time an individual attendant has been in charge of the cashier's booth.

• • •

Emergency Power Units for Water Plants

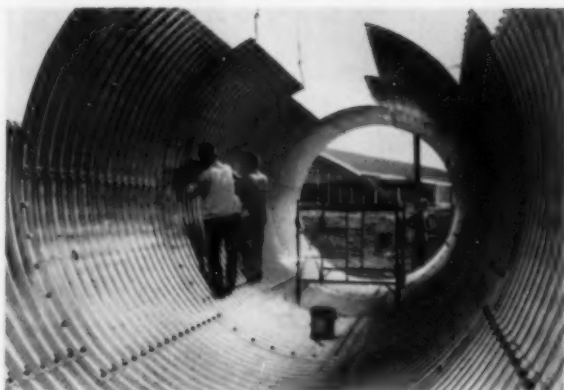
Installation of emergency power generator in all filtration plants and at deep wells in the urban water system has been carried on by the Puerto Rico Aqueduct and Sewer Authority. To date 29 such installations have been made and 19 more are included in present plans.



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● CONSTRUCTION workers assemble section of pipe structure, left, and view of finished parking lot showing pipe location.

River Enclosed to Provide Parking Area

THE SOUTH BRANCH of the Kinnickinnic River prevented use of a 5-acre area badly needed for parking for patrons of the Point Loomis Shopping Center, Milwaukee.

The Sewerage Commission of the City of Milwaukee was called in to help solve the problem of com-

pletely enclosing this part of the river so the area could be used for parking. The engineers decided that the most economical solution would be corrugated metal structures. The final design consisted of three parallel lines of pipe, each 11½ feet in diameter, in 8-gage. These would provide a capacity for a flow of

2300 cfs. The length would be 1,738 feet. The successful contractor, U. S. Sewer Company, Inc., of Milwaukee, bid Armco Multi-Plate pipe for the project.

First problem in installation was to prepare a bypass channel to carry the river flow while the pipes were being installed. This was solved by a channel dug alongside the pipe installation site.

The contractor elected to assemble the pipe on the river bank and bolted the pipe together in 40-foot sections. In all, 33 of these were needed. After lowering the assem-



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with Catch Basin Attachment

cleans
catch
basins
in
minutes



● Proved successful for removal of litter, leaves and other debris from streets, highways, parks, etc., the Good Roads Scavenger, with catch basin attachment, cleans catch basins to an 8 foot depth in a fraction of normal cleaning time. Its powerful 6-cylinder engine sucks wet or dry refuse—paper, twigs,

leaves, stones, bottles, cans, etc.—through its large 12" intake tube into the large capacity hopper. Deep-reaching snout cleans catch basins in minutes—a job that normally takes two men many hours. The Scavenger is available truck or trailer mounted.

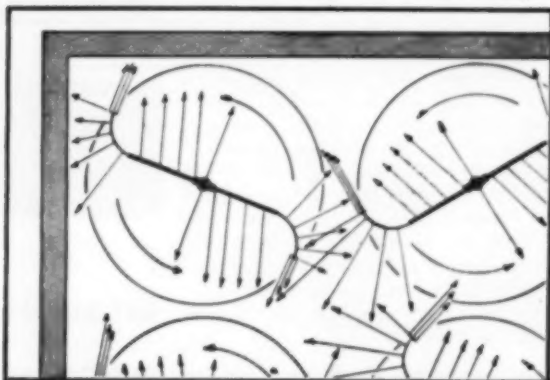
For detailed information on the Scavenger write to the Good Roads Machinery Corporation, Minerva, Ohio.



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in filter cleaning efficiency



New S-Type Filter Arms double the cleaning action

With new S-Type arm of Agitator shown above each corner and void area receives four (4) agitating impulses per revolution instead of two . . . doubling the cleaning action in those areas. S-Type Arms can also be adapted to older units in service. Ask us for full particulars.

(Patent Pending)

Palmer Filter Equipment Co.

822 E. 8th St.
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bled pipe sections onto a pea gravel bed and joining them, crushed bank-run gravel was deposited in layers on both sides of the pipes. This backfill material was carefully tamped.

In addition to the 33 sections, each 40 ft. long, there were 42 8-ft. long connector sections; three 6-ft. connector sections and 9 elbows, aggregating the total of 1,738 ft.

After the lines were connected, the diverted river water was rechanneled through the corrugated metal structures. Fill material covered the tops of the pipes to a depth of approximately 8 feet. Finished surface of the new parking area was provided by compacted asphaltic concrete.

Chemical Weed Control

An appreciable savings in turf maintenance operations has been realized in recent years on county roadsides and park areas by the use of weed-killer chemicals, according to the annual report of the Wayne Co., Mich., Board of Road Commissioners. Neater and safer roadsides resulted with fewer mowings. In 1959, this spraying program included 555 miles of roadsides, equivalent to approximately 2,500 acres, at an average cost of \$9 per acre. Also, 890 acres of lawn areas in county parks were sprayed at an average cost of slightly more than \$6 per acre. Traffic problems and roadside obstacles such as signs, trees, bridge abutments, ditches, etc., as well as travelling time, are reasons why spraying roadsides is a more costly operation than spraying large, open park areas. Approximately 25,000 gallons of 2,4-D chemical was used.

Soil-sterilization treatments were made at 120 county primary road and state trunkline grade separations. The material was sprayed in solution around the abutments and in the expansion joints, cracks and crevasses of the roadway and sidewalk surfaces to prevent the growth of vegetation. The quantity used amounted to 240 pounds.

Fluoridation at Winnipeg

For fluoride treatment of its water, the Greater Winnipeg Water District used 80 tons of sodium silicofluoride last year. It was intended to maintain a concentration of 1 mg/L. Tests made during the year showed the average concentration at 0.96 mg/L. Per capita cost for the sodium silicofluoride was 3½ cents.



Its mirror-smooth interior walls enable KRALOY PVC pipe to deliver 20% greater volume.

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*For direct underground burial, or encased in concrete.

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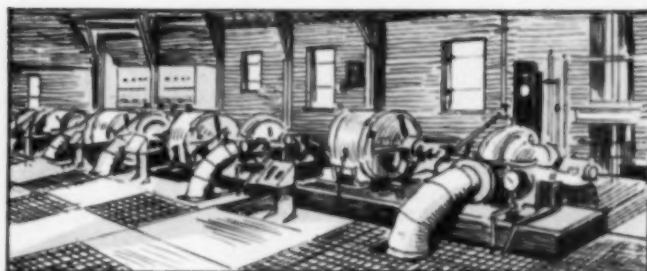
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THE WATER WORKS DIGEST



Prepared by **ALVIN R. JACOBSON, Ph. D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Coagulation of Water

By applying the technique of the colloid chemist, the water chemist can greatly broaden his understanding of the series of changes that take place when a coagulant, with or without a coagulant aid, is added to a water for the removal of color or turbidity. The properties of the turbidity, organic color and softening sludges, which are to be removed by coagulation in water treatment are, in general, the properties of a sol. The two most important instability factors are the Brownian movement and the Van der Waals forces of attraction. The Brownian movement is the movement imparted to the suspended sol particles because of their impact with invisible, rapidly moving particles of the medium. The Van der Waals forces may be described as molecular cohesive forces that increase in intensity as the particles approach each other. The most important stabilizing factors are hydration and the zeta potential. Hydration is the property possessed by some particles to attract relatively large numbers of solvent particles to their surface. With an explanation of these factors in colloidal systems, the author proceeds to an understanding of the mechanism of coagulation of sol particles. The observed facts of water coagulation can be interpreted in terms of these colloidal phenomena. Rapid coagulation of a colloid sol usually takes place shortly before the zeta potential has been completely neutralized. Alum and ferric sulfate both supply trivalent cations and positive zeta potentials and have the ability to precipitate negatively charged color or turbidity by mutual coagulation. The ability of synthetic polyelectrolytic coagulant aids is also discussed. However, there is no logical

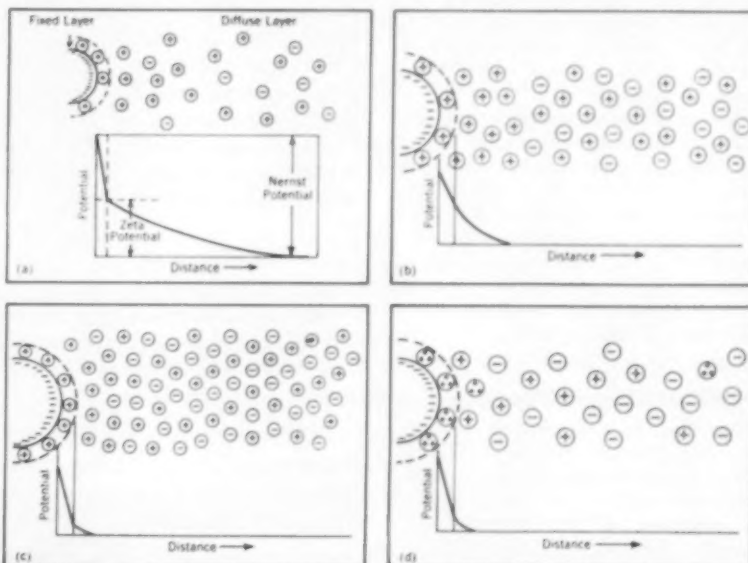
explanation of the fact that certain polyelectrolytes may be quite effective in one situation and relatively ineffective in another. Further research will undoubtedly supply the answers to some of these questions. Several excellent diagrams are included to help explain the material in the text.

"Basic Mechanisms of Coagulation." By A. P. Black. *Journal A.W.* W.A., April, 1960.

The Design of Small Water Systems

For the purpose of this article, the author has limited his discussion to the problems of small water plants; the design standards indicated under the circumstances; the equipment manufactured to serve these special needs; water quantity; sources and treatment; water quality problems; pumping; distribution;

storage; and related factors. As the author emphasizes, it has been apparent for many years that water disease outbreaks have occurred with greater frequency in the small water supplies where the technical operational competence needed to guarantee a water of satisfactory sanitary, chemical and physical quality at all times cannot be expected, or for that matter, economically justified. In many instances, the small water plant operator may also supervise or actually make water service connections, read meters, answer complaints, order needed minor supplies and equipment, run the sewage treatment plant, operate the snow plow, and perform numerous other tasks. Because the operator is given many "additional duties," it is important that the small plant be simple and nearly automatic and with the "hu-



● **NEGATIVE** colloidal particle in low concentration of nonvalent ions is shown in (a); as ion concentration increases more positive ions enter fixed double layer.

Courtesy Journal AWWA



"THESE TRAILS WOULD SHAKE THE CAB OFF AN ORDINARY TRUCK...BUT NOT OUR CHEVY"

Few trucks are subjected to the body-wracking beatings that are part of a day's work for this Chevrolet Series 60 pulpwood hauler, owned by J. E. Fox, North Carolina logging contractor. As Bobby Fox, a partner in the business points out, "Loaded full-up with pulpwood, we drive right over stumps and potholes you'd think would tear the truck to pieces. These trails would shake the cab off an ordinary truck, but not our Chevy. Chevies are built to hold together longer."

■ No matter where you haul, you'll profit by the new toughness that's built into Chevrolet truck cabs for '60. You'll benefit from a cab that stands up to slam-bang runs over rough terrain, a cab that stays in A-1 shape years longer. Here are some of the ways in which Chevy assures this tight, maintenance-minimizing performance:

1. Tough new longitudinal sills reinforce the underbody; provide a solid foundation for cab sheet metal.
2. Extra-sturdy door openings—box-section pillars and sills assure lasting alignment. Doors stay weathertight with a minimum of maintenance.
3. New double-walled roof makes cab stronger and safer. Box-section pillars provide solid roof support.

There's a world of comfort for you, too. A wide seat, for instance, that softens the ride yet gives you extra support where it's needed. And there's more head room, hip room, shoulder room and leg room for rangy drivers.

First chance you get, visit your dealer and drive a new Chevy. Experience new Torsion-Spring Ride. Check up on Chevy's famous gas-saving 6's and V8's. Then you'll know, for sure, why you can expect thousands of extra miles out of a Chevy; why you can be sure of more work per day at least expense. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

1960 CHEVROLET STURDI-BILT TRUCKS

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man element," insofar as possible, eliminated. The designing engineer must be aware of certain inherent differences between large and small plants. These include financial limitations in initial construction costs and operating funds which influence the number of hours of plant operation per day, the methods of handling, storing and feeding of chemicals and the method of operating filter valves, etc. The author has provided a very comprehensive discussion of all the factors which should be considered in the design of small water systems. The material in this article is based in part

on the book by the author, "Environmental Sanitation," John Wiley & Sons, Inc., New York, 1958.

"The Design of Small Water Systems." By Joseph A. Salvato, Jr., Director, Division of Environmental Hygiene, Rensselaer County Department of Health, Troy, N.Y. PUBLIC WORKS, May, 1960.

Charlotte's Water Plant

In 1959 the City of Charlotte, N. C., completed the new Hoskins Water Purification plant and associated pumping facilities which provide an additional 12 mgd of water

for this rapidly growing southern commercial center. The existing treatment plant was activated 34 years ago and, together with its several subsequent additions, provides treatment, storage and high-service pumping facilities for a nominal rating of 24 mgd of finished water. Raw water for these two plants is pumped from the Catawba River. In the new plant, the raw water is pumped into two flash-mixing basins arranged in parallel providing a 60-sec. period of thorough mixing, followed by two flocculation basins providing 45 min. of slow mixing for additional floc formation. Subsequently, the flow enters two parallel sedimentation basins providing approximately 4 hours of settling. After sedimentation, the settled water passes to a battery of four rapid sand filters. The finished water is stored in an underground reinforced concrete clear well with a capacity of 5 mg. For chemical feeding, suitable alarms are provided for a feed rate that is either too fast or too slow. Rate indicators, totalizers and recorders are included. The general control system for the plant is pneumatic but there is some transmission by electric means from remote points. A central control panel provides the operator with a complete picture of the minute-by-minute operation of the plant and of the water levels in the elevated tanks throughout the city.

"Water Purification Plants for Charlotte, N. C." By George S. Rawlins, Executive Vice President, J. N. Pease and Co., Charlotte, N. C. *Civil Engineering*, April, 1960.

Removal of Radioactivity

Conventional water treatment processes can remove substantial percentages of radioactivity from natural waters. Since the present-day problem is principally that of fallout, particular attention is devoted to removal of mixed fission products and strontium-90. In water, part of the radioactive materials are dissolved in true solution while part are present in the suspended or colloidal state. Clarification plants employing coagulation, sedimentation, and sand filtration may remove virtually 100 percent of the suspended radioactivity and from 0 to 30 percent of the strontium-90 content. By the use of about 100 parts per million of clay in coagulation, the efficiency of strontium-90 removal can be increased to the range of 50 to 70 percent in clarification

control



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In small amounts, Triangle Brand Copper Sulfate controls algae growth and kills some of the more troublesome aquatic weeds. They disintegrate where they are, which prevents downstream infestation or clogged waterways.

In sewage pipes, Triangle Brand Copper Sulfate can be used in such

low concentrations to control root and fungus growth that surface trees remain unaffected.

Two informational booklets, "The Use of Copper Sulfate in the Control of Microscopic Organisms," and "Copper Sulfate for Root and Fungus Control in Sanitary Sewers and Storm Drains," available on request.

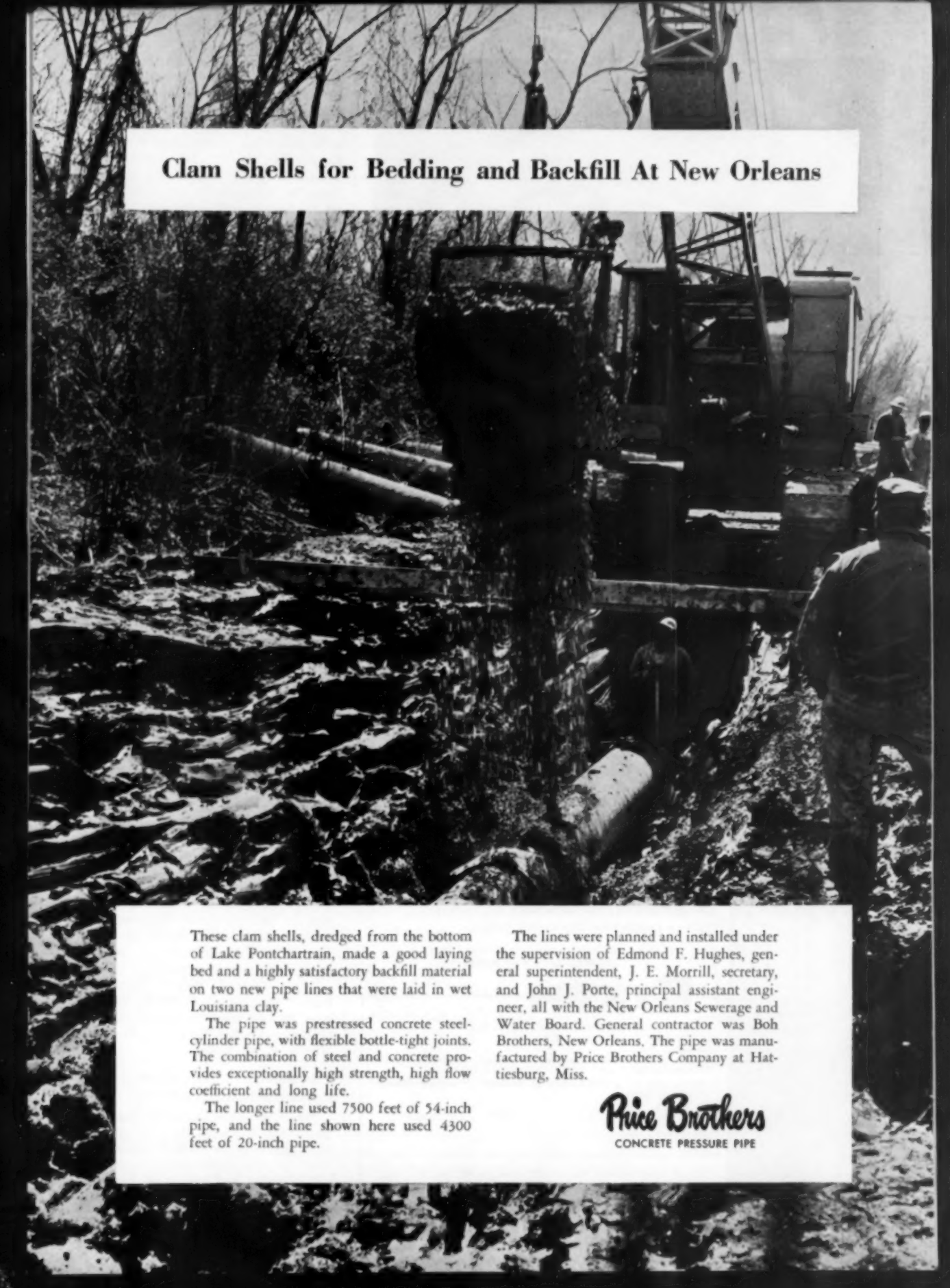
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Clam Shells for Bedding and Backfill At New Orleans

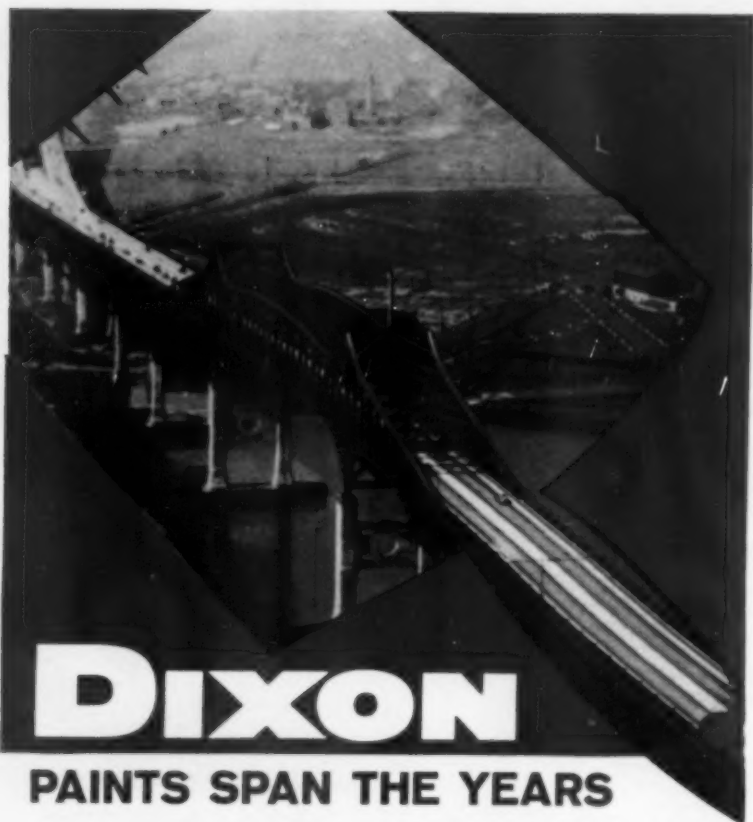
These clam shells, dredged from the bottom of Lake Pontchartrain, made a good laying bed and a highly satisfactory backfill material on two new pipe lines that were laid in wet Louisiana clay.

The pipe was prestressed concrete steel-cylinder pipe, with flexible bottle-tight joints. The combination of steel and concrete provides exceptionally high strength, high flow coefficient and long life.

The longer line used 7500 feet of 54-inch pipe, and the line shown here used 4300 feet of 20-inch pipe.

The lines were planned and installed under the supervision of Edmond F. Hughes, general superintendent, J. E. Morrill, secretary, and John J. Porte, principal assistant engineer, all with the New Orleans Sewerage and Water Board. General contractor was Boh Brothers, New Orleans. The pipe was manufactured by Price Brothers Company at Hattiesburg, Miss.

Price Brothers
CONCRETE PRESSURE PIPE



PAINTS SPAN THE YEARS

The New Jersey Pulaski Skyway is one of the most famous examples of the staying power of Dixon Graphite primers and paints. In 1932 it was painted with Dixon Graphite paints, and it didn't need to be painted again until 1946. Naturally, Dixon Graphite paints were chosen for the second painting. For fourteen years this paint protected the skyway under conditions which would have destroyed ordinary paints in half the time, (heavy industrial fumes, wet salt air and extreme temperatures.)

It is the flake silica-graphite in Dixon paints and primers that give it flexibility so that it won't crack or chip. It forms an air-tight, moisture-proof, chemical-resistant skin that stretches and contracts with the metal, giving protection for many years.

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plants. The modification of such plants to coagulate with phosphates rather than alum can achieve strontium reductions approaching 80 percent at a pH of 9. Municipal lime-soda softening plants also remove practically all of the suspended radioactivity and accomplish strontium-90 removals in the range of 60 to 90 percent. Softening plants modified to provide repeated precipitation can remove up to 99.9 percent of the strontium from the raw water. In the few instances in which ion exchange softening plants are used for treating public water supplies, they can be expected to remove 90.1 to 99.9 percent of the strontium-90 from the applied water.

"Will Treatment Plant Processes Remove Radioactivity In Water?" By Russell L. Culp, Chief, Water Supply Section, Kansas State Board of Health. *Water Works Engineering*, April, 1960.

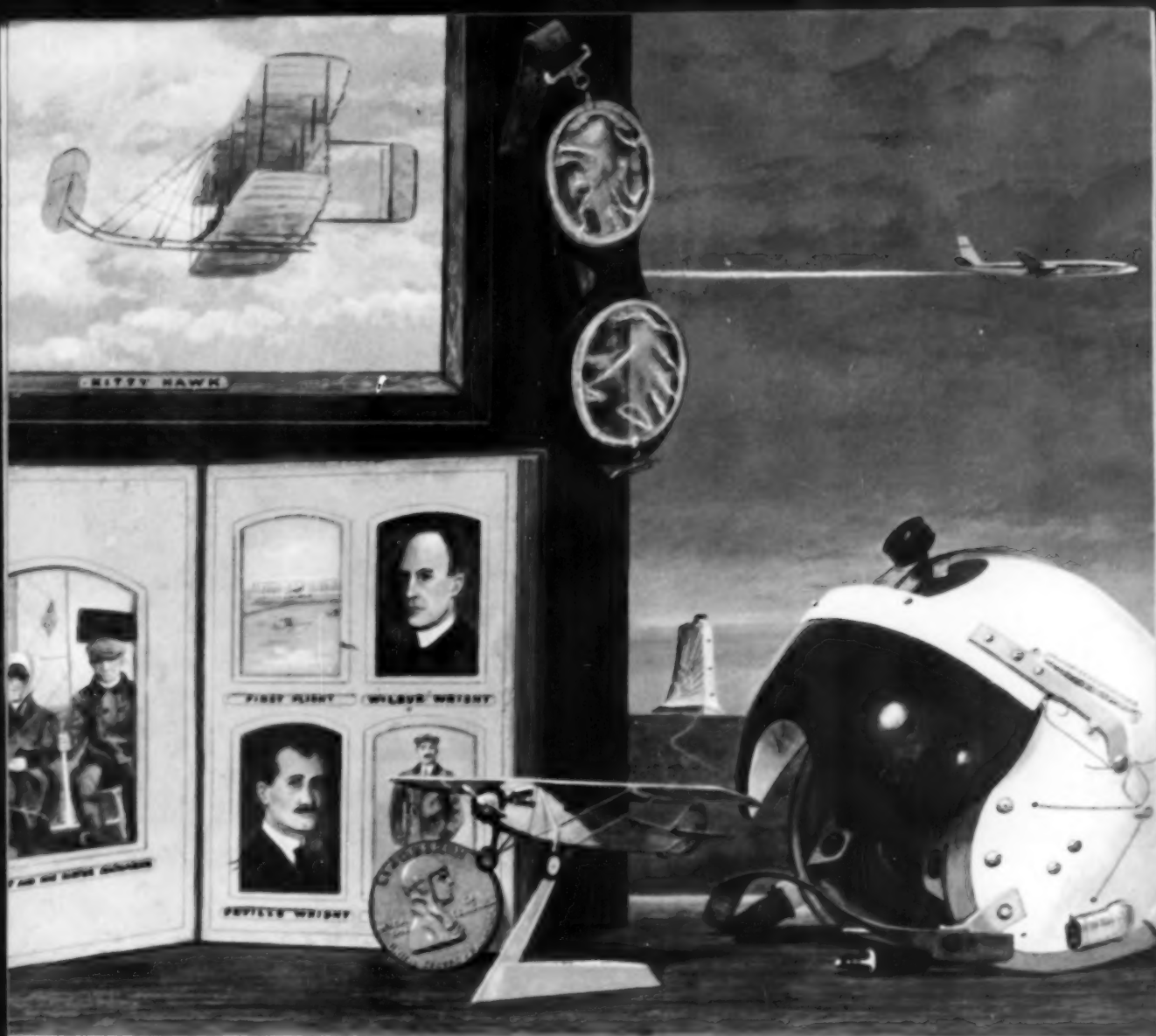
Clinton's New Water Plant

In 1958, plans were prepared and construction was begun on a new 3 mgd filtration plant needed due to the additional growth and anticipated further expansion of the City of Clinton, S. C. This newly completed plant has a raw water pumping station constructed on the bank of the Enoree River consisting of an intake works and a wet well for the pumps enclosed in a brick superstructure. Space was provided for three 2 mgd pumps, but only two were installed. The water is now taken from the Enoree River and pumped 9.5 miles to a raw water reservoir. From there the water flows by gravity to the filter plant with the rate controlled automatically by the level of the water in the flume entering the plant. The water is then coagulated, settled, filtered and chlorinated. Among the interesting features of the installation are the inlets and outlets of the settling tanks, the flexibility designed into the plant and the use of considerable instrumentation.

"New 3 Mgd Water Filtration Plant." By George W. White, President, The Harwood Beebe Co., Spartanburg S. C. *Water & Sewage Works*, April, 1960.

Practical Corrosion Testing

Since Southern California has had particular difficulty with the corrosion of dissimilar metals and alloys used in the fabrication of water works gates and valves, it became



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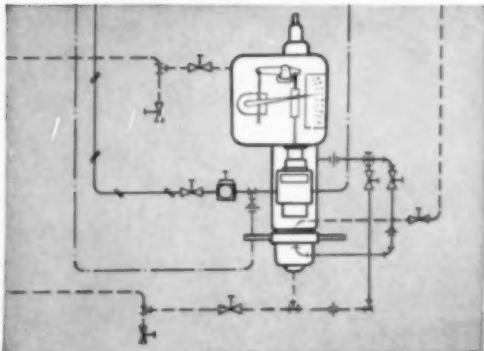
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FLUIDICS AT WORK

New pneumatic transmission system more accurate, more dependable

The diagram shows a typical setup for the new Simplex system for transmitting rate of flow and loss of head to a receiver.

Rate of Flow

The new Type PN transmitter combines the exceptional accuracy and range of a differential converter operated by a mercury float with the traditional dependability of pneumatic transmission.

The transmitter consists of a differential converter which extracts the square root flow function from a primary and then positions a pneumatic motion transmitter. The transmitter produces a pneumatic 3 to 15 psig linear signal. A booster pitot diaphragm in the motion transmitter insures a low lag coefficient and fast transmission.

Besides getting a linear signal without using supplementary pneumatic relays, this new unit gives you point accuracy over wide ranges of flow with minimum differentials. The booster permits accurate transmission over long distances with minimum lag.

Loss of Head

A Type TD transmitter gives accurate readings to within $\pm 1\%$. It uses no stuffing boxes or relay valves, so both installation and maintenance are simple and economical.

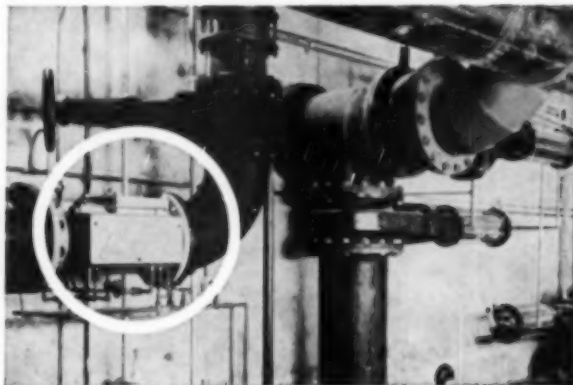
Connected to Simplex Pneumatic Gauges, this new system should give long years of accurate, dependable, trouble-free service.

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FLUIDICS AT WORK

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The differential producer and the modulator lie in a single housing. The actuator is entirely enclosed in a case which mounts directly on the housing.

Result: No complicated piping or drain system to install and maintain.

For a bulletin giving complete specs and performance data, write to our Simplex Division, Dept. PW-60, Lancaster, Pennsylvania. Ask for Bulletin 951.



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necessary to devise practical methods of testing metals or combinations of metals to find those best suited for use in the water distribution systems. The Corrosion Engineering Section of the Los Angeles Water Distribution Division was asked to determine which metals or alloys would be most suitable or economical for use as gate stems, bushings, gate seats, rings and other parts or fittings where failure of water works structures had occurred. To accomplish these ends it was necessary to establish methods for evaluating operating experience and to devise test procedures to obtain data both in the field and in the laboratory. In this article the author describes the suspended-specimen test rack and the crossometer used as tools in testing metals under conditions imposed by local conditions. In the case of water works gate stems, the metals or alloys of which they are made should be placed under conditions of tension, torque, and exposure to corrosive attack not unlike those which they will encounter in water works operations. Service failures of water works gate stems appear to be caused by combinations of all of the following deteriorating effects: 1) Direct corrosion attack upon the metal or alloy used; 2) micro-corrosion cell electrolysis of electrochemically dissimilar crystal constituents of the alloy matrix; 3) progressive deepening and enlargement of minute cracks and crevices initiated by strain and torque stresses applied to the gate stems by intermittent operations of opening and shutting gates; 4) the effects of deposits of corrosion products in the cracks and crevices, such deposits acting as fulcrums to further deepen stress cracks developed under tension and periodic reversal of torsional stresses applied to gate stems by operations of opening and shutting gates. Some of these effects of corrosion can be measured and compared, using laboratory apparatus and equipment such as that indicated in this article.

"Practical Corrosion Testing." By William E. Kirkendall, Water Distribution Division, Los Angeles, Calif. *Water & Sewage Works*, April, 1960.

Diatomite Filter Performance

The use of vacuum diatomite filters in potable and industrial water systems has shown a steady increase during the past few years. The use

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Here's a valve that's as versatile as you want to make it. It can be readily adapted to your piping conditions or process cycles. For example:

Manual or Automatic Operation may be used—by means of four-way valves which control the flow of fluid or air to the cylinders.

Air, Oil or Water may be used for the operating media—and can be piped from the lines on which the valves are installed.

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Write for detailed information or quotes, giving size of valves required, kind of valves (Iron Body Bronze Mounted, All-Iron, Bronze, Special Alloy, etc.), service conditions, maximum disc pressure and minimum cylinder pressure.



DARLING VALVE & MANUFACTURING CO.

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of this type of filter in swimming pools is well known—of some 10,000 municipal and institutional pools built in 1958, 53 percent were filtered by diatomite units. The vacuum filter is gaining increased favor for several reasons. It is an open-tank installation with porous filter leaves or tubes within the tank, connecting to the effluent system on the downstream side of the filter. The effluent system is usually connected to the suction side of a centrifugal pump rated for a desired capacity against a total dynamic head of the normal back pressure plus maximum suction that will be developed at the

end of the filter as the filter cake builds up. Because of its open construction it is usually possible to observe the filter cake throughout the entire filter run. At the end of the run, the effluent and influent valves are closed, the tank is drained and spent cake—with filtered material attached—is rinsed or washed from the filter elements with a hose or by the use of spray nozzles. This method of cleaning has been found more efficient than back-washing by reverse flow. Improper operation or inadequate coating of the elements can be readily detected and remedied. Tanks for the vacuum-filter

unit can be made of fiberglass-reinforced plastic with steel framework, steel or even concrete. While tubular elements are most common, leaf-type elements offer more plane surface, making them easier to clean and inspect. Consulting engineers should investigate the applicability of diatomite filtration to municipal water-supply systems, there being both advantages and limitations to this process.

"How Diatomite Water Filters Are Performing." By H. N. Armbrust, Project Engineer, B-I-F Industries, Providence, R. I. *The American City*, April, 1960.

Other Articles

"Leak Surveys and Control of Unaccounted-for Water." A joint discussion presented on October 8, 1959 at the Chesapeake Section Meeting, Baltimore, Md. "The Program at Baltimore." By Karl H. Schamberger, Principal Engr., Div. of Conservation, Bur. of Water Supply and "Practices in the District of Columbia." By Roy L. Orndorff, Deputy Director, Dept. of San. Eng., Washington, D. C. *Journal A.W.W.A.*, April, 1960.

"Design and Operation of the Midland Treatment Plant." A joint discussion presented on Sept. 23, 1959, at the Michigan Section Meeting, Saginaw, Mich. "Design and Construction." By John C. Seeley, Cons. Engr., McNamee, Porter and Seeley, Ann Arbor, Mich.; and "Startup and Operation." By Charles A. Froman, Supt. of Utilities, Midland, Mich. *Journal A.W.W.A.*, April, 1960.

"Training Swimming Pool Operators." Some facts about the training program for swimming pool operators in Texas. By Robert B. White, Senior Engineer Assistant, Texas State Department of Health. *Public Works*, May, 1960.

• • •

Speeding up Trench Paving With a Special Bucket

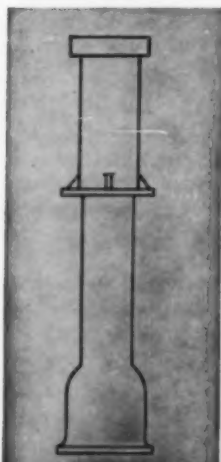
Using a Huber-Warco maintainer, Joseph Noonan & Sons, Inc., Saratoga Springs, N. Y., developed a quicker way to pave trench cuts. The maintainer was equipped with a special bucket a few inches narrower than the trench opening; a wheel was bolted on to help maintain a uniform depth of cut; by tipping the bucket, it was possible to cut to a depth of 8 ins., but usually 5 ins. of the temporary fill were removed. As the maintainer moved ahead, excess fill flowed into the loader bucket, which was dumped, when necessary, into a truck. After this quick and economical removal of temporary fill, broken stone was placed and rolled, using a truck, and covered with 2 ins. of hot-mix.



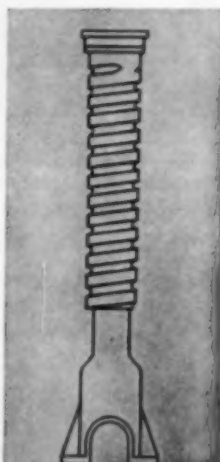
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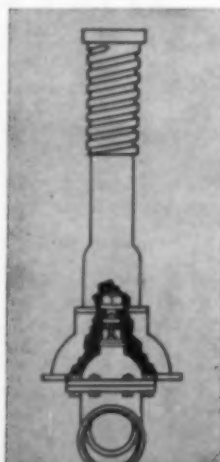
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Each increase in demand shrinks the narrowing gap between normal and maximum requirements, gradually cancelling-out the "safety valve" of unused reserve power.

When did you last review your continuous duty and standby power facilities... and the "left over" power of continuous duty day-to-day equipment? Yesterday? Eighteen months ago?

All America is growing, industrially and population-wise, at an accelerating pace. Faster this year than last... next year, still faster. More frequent reviews of power facilities and potentials are necessary.

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and standby use are saving thousands of dollars in low first cost, low fuel cost and low upkeep of these quiet, compact, unbelievably efficient engines. And, no wonder...

40 per cent fewer moving (wearing) parts than comparable engines of equal horsepower... more power in less floor space... light in weight, virtually vibration-free, usually eliminating the need for complicated and expensive foundations... turbocharged, if desired, for a 50 per cent increase in power... easily modified as a dual fuel or high compression spark ignition unit with both types burning natural gas, commercial propane, other gaseous fuels—even sewer gas—without loss of horsepower or economy!

Here, indeed, is the taxpayer's friend, built by the pioneers of diesel building in America. No other manufacturer builds so great a variety of diesel engines for all services and purposes (for fireboats, too), from one-cylinder and five hp to 12-cylinder, 4200 hp... and matching pumps, generators, alternators and generator sets.

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RADIOACTIVITY in Water Supplies

THE HOME water softener is becoming a high priority home appliance in this atomic age because it also has the virtue of removing 85 to 90 percent of radioactive impurities from the water it conditions. Permutit dealers report that, in suspect areas, new customers feel that if they can enjoy the benefits of softened water in their homes, and protect their families against possibilities of radium poisoning as well, the residential water condi-

tioner is something to think twice about. Another consideration is the capacity of the softener to repurify water in case of nuclear sneak attack or possible sabotaging of reservoirs.

Recent inconclusive charges of atomic water pollution in the Pittsburgh-Wheeling sector of the Ohio River, involving a nuclear power plant upstream caused a boom in water softener sales. While water itself never becomes radioactive, it

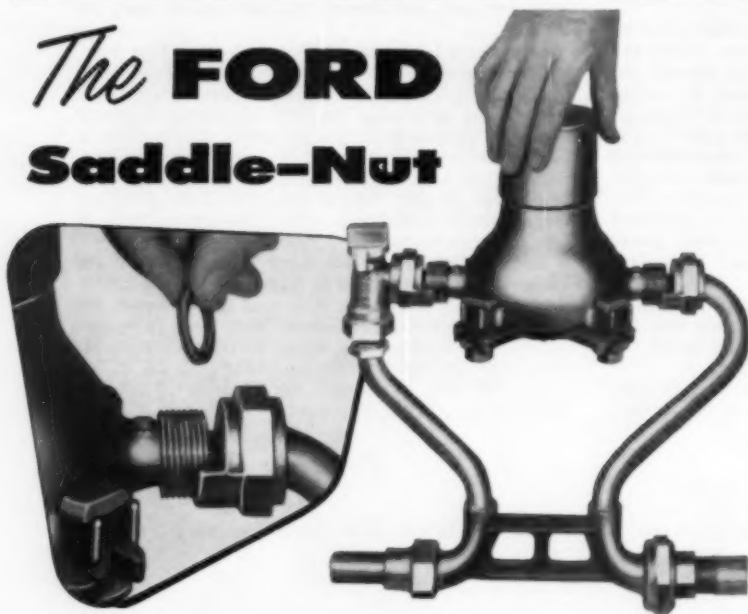
is the dissolved minerals and suspended impurities which may be radioactive, and water conditioners containing suitable ion exchange resins remove virtually all of the radioactive impurities from the household water supply.

The Atomic Energy Commission does its best to monitor and control all possible danger spots, and issues warnings where the radioactive count appears to be excessive. A cause of contention on the part of some, however, is the fact that active elements tend to remain and build up in the human system over a long period of years, and to concentrate in certain parts of the body. Some argue that even microscopic amounts in water supplies may eventually prove injurious or even lethal, since one part in 250 trillion is considered to be above the safe minimum. The question at issue is, how much is too much.

Atomic power plants are required to dispose of the highly active fuel residues from their nuclear furnaces in shielded containers which are buried in old mine shafts, or dumped far out at sea. However, it is possible for small amounts of incidental contamination to escape into adjacent waters in the cooling water, from the dust of surrounding air or from other minor elements discharged by a nuclear plant. There are 15 large nuclear power plants now in existence or under construction, and another 13 in the planning stage. These will be located in 18 different states from coast to coast. In addition there are more than 50 smaller reactors now being operated by universities, research organizations or government agencies. Nuclear power is still in its infancy and future expansion will require additional methods of control. Repurification of water supplies, both for home and industry, may constitute a major industry in itself.

Actually, nuclear reactors are so carefully watched by AEC that they are the least cause for concern. Fall-out and natural deposits of radio-active minerals create more danger. The amount of atomic dust in the atmosphere and stratosphere has been increasing as a result of the growing number of countries conducting tests of nuclear bombs and weapons. This is dispersed all over the globe falling in rain or

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Save time . . . Save trouble . . . Save gaskets, by putting the FORD SADDLE NUT at inlet, or both ends of every meter installation.

The patented Ford Saddle Nut has a supporting lip extending about half way around the meter nut, so that it supports the weight of the meter, lines up the threads of the nut with the meter spud, and provides a place to hold the gasket before the nut is screwed onto the meter.

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FOR BETTER WATER SERVICES

THE FORD METER BOX COMPANY, INC. Wabash, Indiana

settling to the ground as dust, where it may be washed into water supplies. The U.S. Naval Research Laboratory reported that the concentration of radioactivity in the air at points in the U.S. increased 300 percent after the series of tests conducted by Russia.

There are many parts of the country in which the water seeps through natural deposits of radioactive elements and salts, contaminating it before it ends up in a water system. According to the Atomic Energy Commission, 600,000 residents of northern Illinois are drinking water above the danger mark. The same is true in parts of Wisconsin and Indiana, and many other sections of the country.

The New York State Department of Health recently completed a survey of the entire state, except for New York City, including a study of two million births, and found a correlation between the incidence of congenital malformations and the amount of radioactivity in the potable water supplies of various areas.

Increasing sales of home water softeners, resulting from their ability to eliminate radioactive impurities, are not considered a temporary trend. There are many places where household water conditioning is a vital requirement, and there will be more. There are still 25,000,000 home owners who need and can afford conditioned water.

Because of new designs and rapidly increasing sales in this category, the development of a new home fluoridation unit for the prevention of tooth decay, and other product diversifications, Permutit has created a separate new corporation to be known as Permutit Water Conditioning Inc.

• • •

Awards for Sanitation Programs

Awards for outstanding sanitation programs, the Samuel J. Crumline awards, have been made to two local health departments. For the Marion County, Indiana, division of public health, recognition was based on a program of eating and drinking sanitation. Dr. Henry G. Nester is health officer, Alfred L. Klatte is director of environmental sanitation and Siegel Osborn is supervisor of the food section. The award to the San Bernardino Co., Calif., health department reflected a wide coverage of categories affecting health. Dr. M. E. Cosand is health officer and Richard E. Elliott director of sanitation services.

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sliding or screw type cast iron valve boxes for covering 4" thru 10" valves for water or gas. Rugged construction for lifetime service. 5 1/4" shaft. Extensions as required.

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valve boxes supplied with separate bases are available in sliding or screw type. Made with 5 1/4" and 7" shafts with extensions as required. Complete line of service and road-way boxes.

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NEW CASTLE, PA., U. S. A.

Off-Street Parking Garages for New York City

A PROGRAM to provide nearly 10,000 off-street parking spaces in midtown Manhattan has been recommended by T. T. Wiley, Traffic Commissioner, following a study by Charles E. DeLeuw, Consulting Engineer. These are to be provided in 15 new facilities, all within 1,000 feet of major stores and offices in the midtown area—between 22nd and 59th Streets and 2nd and 8th Avenues. Of

these facilities, 14 are to be self-parking garages and one will be a mechanical garage. The program is part of a 10-year master plan announced in 1955.

In his report, Commissioner Wiley pointed out that the closing of large retail stores in midtown Manhattan had, in the past ten years, resulted in the loss of 30,000 retail jobs. Survey studies showed that suburban

shopper trips have decreased 57 percent since suburban shopping centers have been opened. While 85 percent of midtown shoppers reported at least one shopping trip every three months, only 30 percent of the suburban shoppers showed a comparable frequency in trips to midtown.

It is not the purpose of the midtown parking program to entice all shoppers in outlying centers to return to the New York midtown stores. Provision of additional parking space alone could never achieve this end. Yet, failure to combat this trend to the suburbs could have serious effects on the economy of mid-Manhattan and on job opportunities provided, if nothing were done to maintain retail patronage for these stores.

In 1955 the New York Metropolitan area had a population of 15,225,000. There are approximately 26,500 off-street parking spaces in the midtown Manhattan area at present, about the same number as provided by the downtown Cincinnati area, which serves a metropolitan regional population of only 1,000,000 persons. More than one-third of the presently available spaces in New York cannot be considered permanent. Some are on sites for which new buildings are planned; many are uneconomical because they are not designed for large, late-model cars.

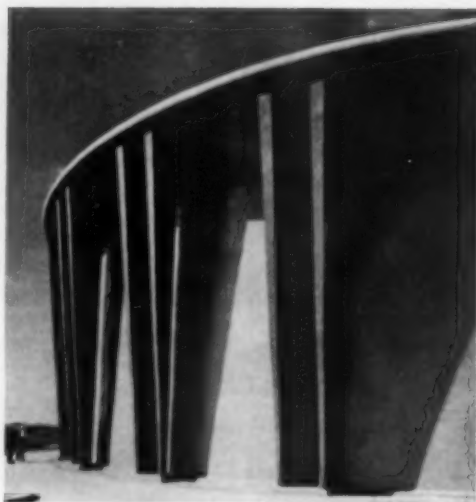
Since the end of World War II, more than 30,000,000 square feet of new office space has been planned or constructed in the central business district. This continuing transition from industry and manufacturing to commerce and business can be expected to generate a great number of short-time, off peak-hour trips to the central business district, many of which will be made by automobile. In the meantime, curb parking facilities have been drastically reduced to meet demands of moving traffic, and further reductions below the existing 23,250 spaces are probable. Parking meters are operating close to the saturation point while overtime parking is reducing availability of metered curb spaces where 35 percent of the cars preempt 67 percent of the parking time.

At existing off-street facilities, many of which are temporary, rate schedules favor the all-day parker who usually contributes to street congestion at peak hours. At the newly proposed facilities, rates will favor the short-time parker who is more likely to be a shopper who will enter and leave the area outside the peak traffic hours.

WEST VIEW, PA. chose a STEEL TANK

An entire hilltop was removed to make room for this 5,000,000 gallon steel reservoir built for the Municipal Authority of the Borough of West View, Pa. A striking example of special architectural detailing and exacting craftsmanship combined to provide visual appeal in this high-value residential district. Decorative pilasters and a two-tone blue color scheme complete a most unusual and applauded neighborhood feature.

Designed by William Murdoch, Consulting Engineer, Pittsburgh, Pa.



... the only type of water storage tank built to AWWA standards!

STRENGTH
TIGHTNESS
ELASTICITY
ECONOMY
LONG LIFE

... these are inherent qualities of welded steel construction. Compare steel tanks with other types... you'll see why "steel tanks store water best." You can always specify steel tanks with confidence.

For your copy of the latest steel tank brochure, write—

STEEL PLATE FABRICATORS ASSOCIATION
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From the study, it was found that: One out of every four persons shopping in Midtown comes by automobile, a substantial number of drivers, considering the present unfavorable parking conditions.

Shoppers questioned cited the large selection of goods at mid-Manhattan stores as the most important advantage of coming to the city. Other major factors listed are the opportunity to combine several errands in one trip, better values, proximity of stores and convenience of public transportation.

Nearly 50 percent of these shoppers rated availability of convenient parking as the most important factor that would encourage more frequent shopping trips to the midtown area.

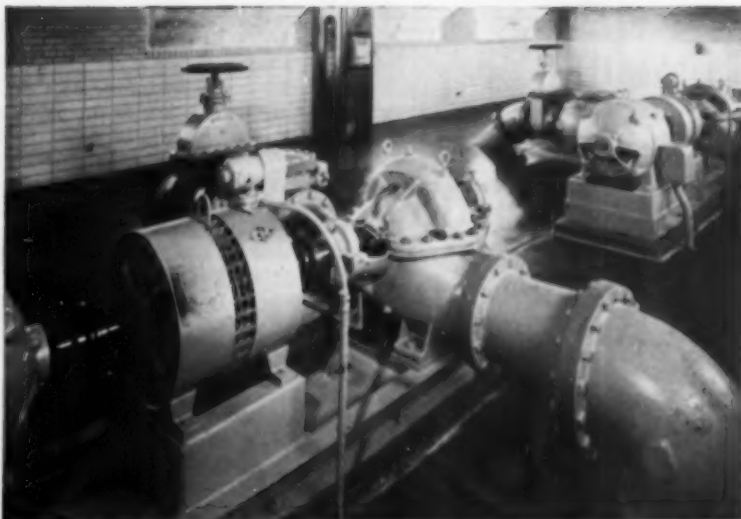
Two-thirds of all shoppers questioned said they would use municipal self-parking garages having a 25 cents an hour rate. Existing garages average 95 cents for one hour or less; \$1.28 for two hours and \$2.31 for all-day parking. Lots have slightly lower charges. Where cars are parked by attendants, the cost for labor for each car parked is about the same, regardless of the length of stay. This results in a high rate for short-time parkers.

About 84 percent of midtown shoppers using automobiles and 60 percent of those using other transportation stated they would definitely utilize these facilities. All indications by these shopper attitude studies showed high acceptance.

In New York City, the number of registered vehicles has doubled since 1946. The ratio of population to vehicles registered has at the same time decreased from 11.7 to 6.0. Moreover, in suburban areas where greatest population growth has occurred, there are currently less than half as many persons per automobile as there are in New York City. It is evident that automobiles are playing, and will continue to play, an increasingly important role in the life of the metropolitan region and the city.

In 1956, approximately 519,000 vehicle-trips per day were made to Manhattan south of 61st Street. This was an increase of about 36 percent over 1948. The traffic flow represented by the movement of this number of vehicles, according to the Midtown Manhattan Parking Study, would not be greatly affected by the addition of 10,000 parking spaces in the same area, especially since the garages are intended to serve primarily the types of trips made predominantly in mid-day. About 3,000 autos would leave the garages in the rush hour.

PUBLIC WORKS for June, 1960



E-M Ampli-Speed Drives provide Odessa, Texas Municipal Sewage Plant with adjustable pumping rate of 1 to 5.4 MGD. Pumps are held to $\pm 2\%$ of manually selected speeds.

Make two pumps do the work of three!

Here's how Odessa, Texas did just that with
adjustable speed E-M Ampli-Speed Drives

PROBLEM: Odessa, Texas wanted to increase sewage facilities to treat sewage effluent as a source of industrial water for chemical and rubber plants.

OBJECTIVE: They needed a new, efficient sewage pumping station at minimum cost, with provision for future capacity.

SOLUTION: Odessa officials called in Parkhill, Smith & Cooper, consulting engineers of Lubbock, Texas. P. S. & C. suggested two alternatives: 1. Build a plant with three pumps, including one for peaking and standby; or 2. Install two pumps with E-M Ampli-Speed Drives.

Parkhill, Smith & Cooper favored the 2-pump plan for these reasons:

Minimum Capital Investment. The three-pump plan would tie up a considerable amount of capital in an extra pump, motor and control without adding appreciably to the

volume of sewage pumped.

100% Peak Standby Capacity. Two pumps with E-M Ampli-Speeds could handle present demand efficiently, yet still have enough reserve capacity for 100% peak standby.

Low Cost Expansion. Later another pump could be added to double the station capacity and still allow 100% peak standby. And as a further saving, the building would *not* have to be enlarged to accommodate this third pump.

RESULT: Odessa took the advice of its consulting engineers and is now enjoying efficient, low cost pumping.

As your pumping requirements grow, you too will want the economy and versatility that E-M Ampli-Speed Drives give you. Write the factory today for descriptive Ampli-Speed Bulletin No. 243, and call your nearby E-M Sales Engineer for details.



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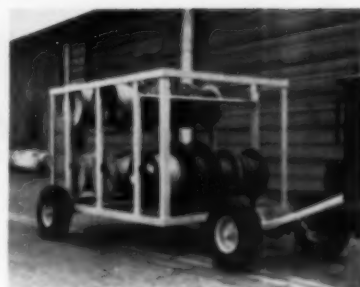
A basic design has been developed for a standard garage and this has been adapted to 12 sites. This provides for one-way traffic movement; there are no columns in the parking area; movement within each could be reversed if the present one-way street pattern were changed; and these garages are entirely self-parking. Each has two subsurface parking levels, a street-level floor and six levels above ground.

About \$57 million will be required for construction. After the third year of operation, when construction will have been substantially completed, gross revenue is estimated at \$5.6 million and operating expense at \$1.577 million. Based on 30-year 4 percent general obligation bonds, annual surplus is expected to be \$726,000.

• • •

Alhambra Converts Bomb Trailer to Wire Reel Carrier

THE SIGNAL crew of the traffic division of the Engineering and Street Department of Alhambra, Calif., had long been in need of a more expeditious method of handling traffic signal wire. It was suggested by City Engineer R. G. Bezant and Traffic Signal Foreman Charles Brackin that one of the bomb trailers available from sur-



• **TRAFFIC** signal wire reels are handled easily by this unit that was converted from surplus bomb trailer.

plus government property could be modified to meet this use. After inspecting these trailers and finding them usable and adequate, negotiations were made by Civil Defense Director Leo Wayland for the acquisition of a trailer.

Alteration of the bomb trailer to a wire reel carrier was taken over by Shop Superintendent William Ebersole. After an investment of approximately \$200, the trailer was altered as shown in the accompanying photograph to handle the traffic signal wire reels.

This equipment has greatly expedited installation of traffic signal wire. The reel carrier is designed to accommodate different sizes of reels and will handle 24 reels of traffic signal wire.

In a civil defense emergency, this wire reel carrier could be used to lay communications and power lines at a rapid rate to replace inoperable facilities.

Lengthy Water Meter for Chicago

A SPARLING meter, with a column more than 80 ft. long, is part of the equipment installed in a program to increase the capacity of the Chicago municipal water filtration system from 320 to 480 mgd. The maximum output will be 800 mgd. The propeller for the meter is located 74 feet below water level and is aimed into a downward flow. It is attached to the meter by an 80-ft. drop shaft of wrought-iron pipe six inches in diameter. The propeller is 36 inches in diameter and its six blades are fabricated from aluminum. The installation is equipped with a Sparling indicator-totalizer-recorder which is mounted at the surface.

• **SPARLING** meter being readied for shipment to Chicago water system. Sectional column is over 80 ft. long.



STEVENS TOTAL FLOW METER Model 60M



Low-cost meter provides essential flow data for operation of sewage treatment plants

- **INDICATES FLOW**—Rate of flow and head are indicated by pointer and scale.
- **INDICATES PEAK FLOW**—Sliding red index on scale indicates peak flow.
- **TOTALIZES VOLUME**—Counter totalizer registers total flow.

Mechanically operated meter provides essential data in measurement of sewage, industrial wastes, irrigation water or other liquids flowing in open channels. Standard meter gives direct flow reading in cu. ft./sec. and totalizes volume in cu. ft. Readings are easily converted to other units of measurement.

The instrument is designed for use with Parshall flumes and various weirs. It is entirely mechanically operated, will function without attention for eight-day intervals, and is easy to install on table, shelf or wall. If a graphic record is desired, the meter can be used with a Stevens Type F Recorder. Write for Stevens Hydrologic Instrument Short Form Catalog No. 23, and for Bulletin 28 which describes the Model 60M meter in detail.

HYDROGRAPHIC DATA BOOK—Valuable reference file, 124 pages of technical data on recorder installation, plus a wealth of hydraulic tables and conversion tables. \$1 copy. (No C.O.D.'s)



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1960

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New York, N. Y. • August 14-17

Register Early — Win a Car!

Those who pre-register will

receive the following **FREE**:



1. A gold covered notebook with a ball point pen—retail value \$1.00. Courtesy of the Local Committee.



2. A personalized portfolio with your name printed in gold (an equally attractive portfolio will be given to the ladies) — retail value \$3.00. Courtesy of the

New York-New Jersey Metropolitan Chapter.

3. Free participation in a drawing for a 1960 automobile (approximate price \$3,500). Only members who pre-register will be eligible. The car will be delivered to the winner's home town.



Pre-Registration: How It Works

Pre-registration will help you and us. In addition to the many gifts which you will receive, it will also allow you more free time to visit exhibits and renew acquaintances. It will enable the Local Committee to plan the events better—to make the 1960 Congress a smoothly functioning affair for your increased enjoyment.

Registration fees are as follows:

Members	\$15.00
Non-Members	20.00
Ladies	10.00

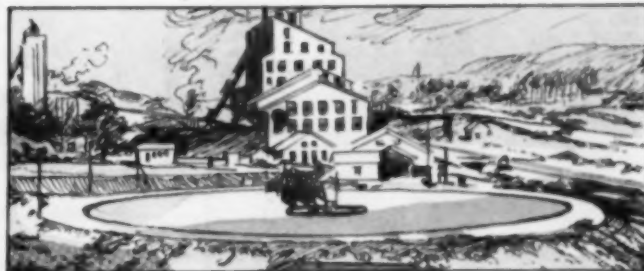
Participation in the special prize drawing for the automobile is limited to members of the APWA. Only those members who pay their \$15.00 fee in advance and pre-register on the form provided are eligible for the special (car) drawing.

For full details, a pre-registration form, and a hotel reservation form write:

American Public Works Association

1313 East 60th Street, Chicago 37, Ill.

THE INDUSTRIAL WASTE DIGEST



Prepared by **CLAYTON H. BILLINGS**, Associate Editor

Aerated Waste Treatment Lagoons

By the installation of diffused air or mechanical means of aeration of waste disposal lagoons, it is possible to overcome some of the disadvantages of the lagoon disposal method, the potential odor problem and the large area requirements. Aerobic oxidation of organic matter in lagoons is analogous to the natural purification of streams. Therefore, aerobic conditions prevail as long as the rate of oxidation does not exceed the rate of aeration. The surface reaeration equations developed by O'Connor and Dobbins were employed in an example of a design problem to determine the size of a lagoon and the nature of the aeration system required to effect a prescribed BOD reduction in an industrial waste. Laboratory studies provided data on oxidation rates and surface and diffused aeration characteristics were established from field studies. The investigation was based on canning and pulp and paper mill wastes. The authors point out that the coefficient of surface aeration in an aerated lagoon is related to the average velocity gradient at the water surface and the coefficient of diffused aeration is affected by the nature of the diffusion device, air flow and lagoon depth.

In a discussion of the paper, Harold E. Orford suggests that the use of design criteria based on theoretical considerations of aeration should involve the effect of benthic oxidation. Solids which settle to the bottom of a lagoon exert a demand which may be intermediary between aerobic and anaerobic and which should be of significance in aerated lagoons because of the solids accumulation occurring. The benthic oxygen demand was calculated for the example and it was found to in-

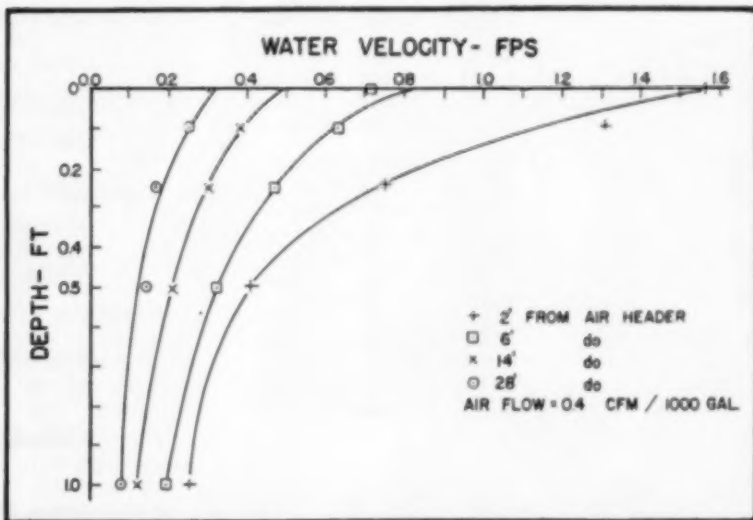
crease the air requirements of the design by 54 percent. It was explained by Orford that the agreement between theoretical calculations and field results achieved by Eckenfelder and O'Connor might have been due to the possibility of their using new field lagoons in which no bottom sludge had accumulated.

"Treatment of Organic Wastes in Aerated Lagoons." By D. J. O'Connor and W. W. Eckenfelder, Jr., Manhattan College and "Discussion" by H. E. Orford, Rutgers U. *Journal Water Pollution Control Federation*, April, 1960.

Phenolic Wastes

Bench scale and pilot plant studies were performed on biological oxidation of phenol wastes originating at Tinker Air Force Base to evaluate treatment by trickling filters and the activated sludge process. In the

bench scale studies two types of apparatus were developed for acclimatizing sewage slimes to phenol. These consisted of a rotating drum constructed of frosted glass and the other an aeration chamber improvised from an Imhoff cone. The slime growth on the rotating drum was shown, by measuring the radio-phosphorous uptake, to behave as the slime on a trickling filter. The method of operation was on a batch basis using sewage, phenolic waste and nutrient. It was shown that constant continuous loadings of 1,000 mg/L of phenol on the drum and 2,000 mg/L in the aeration cones could be handled satisfactorily. The studies were then made on a pilot plant scale using a trickling filter, a rotating drum and an aeration tank. Equalization of flow, neutralization and emulsion breaking preceded biological treatment. Both laboratory and pilot plant investigations indicated that phenol can be oxi-



● TYPICAL vertical velocity profiles in lagoons with air flow of 0.4 CFM / 1,000 gals.



PRIMARY TYPE SLUDGE COLLECTORS



V-BUCKET GRIT COLLECTORS



CONVEYORS FOR LIME



VERTICAL BACK-CLEANED SCREEN

Specify dependability with **JEFFREY** equipment



DIFFERENTIAL CONTROL with visual
"loss-of-head" gage for automatic
sewage screen operation

SHOWN here are some of the many types of equipment produced by Jeffrey for sewage treatment plants. Jeffrey offers *dependability*—proved by years of experience in large and small plants. Jeffrey engineers can help you in application of this equipment for efficient results. For complete information, write The Jeffrey Manufacturing Company, 947 North Fourth Street, Columbus 16, Ohio.



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TRANSMISSION MACHINERY... CONTRACT MANUFACTURING

dized successfully in concentrations as high as 7,500 mg/L. The rotating drum plant was best for high phenol concentrations. Trickling filters were satisfactory for sewage and phenol mixtures if the content of the latter is kept below 100 mg/L. Activated sludge treatment following NRC standards was very successful for phenol concentrations up to 500 mg/L or BOD up to 1,000 mg/L.

"Phenolic Wastes from Aircraft Maintenance." By G. W. Reid, Robert Daigh and R. L. Wortman, respectively Professor of Civil Engineering, Univ. of Oklahoma; Sanitary Engineer, Hq. AMC; and Grad-

uate Student, Univ. of Oklahoma. *Journal Water Pollution Control Federation*, April, 1960.

New High in State-City-Industry Cooperation

Under the urging of Maryland water pollution control officials, the West Virginia Pulp and Paper Co. at Westenport, Md., commenced in 1956 to plan construction of a waste treatment plant. As plans developed, the municipalities of Luke and Westenport, Md., and Piedmont, W. Va., requested that the treatment plant also accept their municipal wastes. To permit such an ar-

rangement, the Maryland General Assembly broadened the power of the Upper Potomac River Commission to cooperate with the industry and city to undertake the project. The Commission issued \$4-million in bonds to finance the building of a 21-mgd activated sludge plant and sewer. The cities were offered two alternatives in participating in the effort. They could either 1) construct and finance necessary interceptor and trunk lines with the wastes treated without cost to them or 2) they could share the costs of financing and operating the treatment plant and necessary transportation facilities, with the Commission performing the work and obtaining reimbursement from the various participants in proportion to flow volumes. Westenport chose the second alternative and Luke the first; Piedmont will make its decision after engineering studies are completed and legal problems involved in interstate cooperation are solved. The industry constructed a primary clarifier through its own resources to treat paper mill wastes. It is arranged to discharge effluent through the trunk sewer to the Commission plant when and if complete treatment of the paper mill wastes is deemed necessary. The pulp mill wastes are piped directly to the activated sludge plant owned by the Commission. At the Commission plant 95 percent of the flow will be industrial and 5 percent municipal. The combined BOD is expected to be 263 ppm and suspended solids, 290 ppm. A unique feature of the plant is the use of turbine aerators which involve a combination of diffused and mechanical air dispersion.

"Largest Activated Sludge Plant for Pulp and Paper Wastes Will Treat Sewage from Three Towns." *Wastes Engineering*, April, 1960.



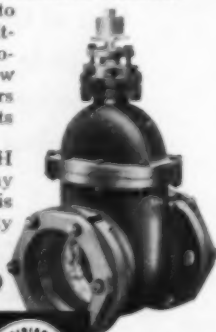
As the Twig is Bent

To understand and appreciate the products and services of a 34-year-old industry, you need to know something of its background. Industrial growth and success do not just happen by accident in our American competitive free-enterprise system. "As the twig is bent, the tree's inclined." Therefore, this is the first of a series of institutional advertisements to illustrate how many years ago the M & H twig was bent to produce today's thriving industrial "tree" known as the M & H Valve and Fittings Company.

To begin with, M & H is an example of how civic spirit pays off. Anniston Chamber of Commerce and a group of Anniston business men in 1925 raised money by public subscription to buy used equipment to manufacture valves and fittings. The M & H plant was built and started production in 1926. In the following 5 years, the new Company gave little indication that within 25 years M & H would be one of the leading industries in its field.

How, when and why these highlights of M & H history occurred, may be a matter of interest today to water works engineers and public officials. It is the background in which M & H product-integrity is deeply rooted.

(No. 1 of a Series)



M & H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA



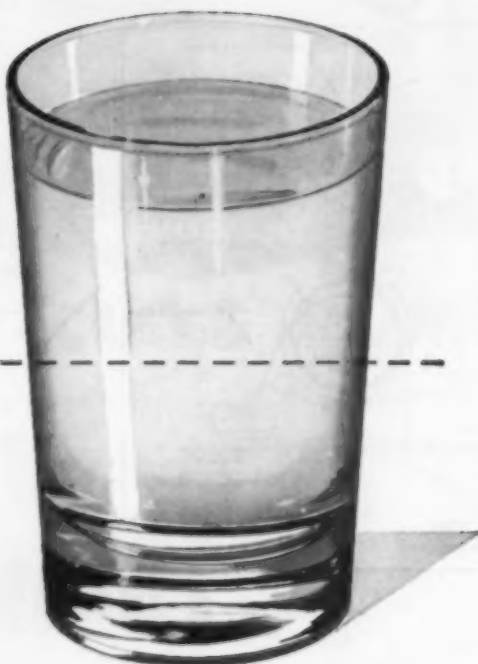
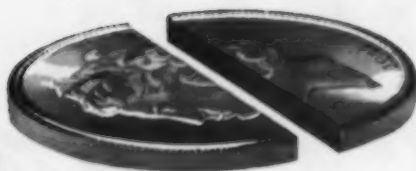
Meteorology and Air Pollution

The present aims in studying the meteorology of air pollution are measurement, understanding and prediction. Through proper selection of industrial sites, local contamination can be minimized; through meteorological detection measures, offending industries can be uncovered; and through forecasting, pollutants theoretically can be withheld until conditions are conducive to atmospheric discharge. Meteorological study has so far succeeded in identifying weather conditions responsible for large scale

NOW...

**cut new filtration
plant costs 45%**

**Increase
clear water
capacity
100%**



Specify Celite diatomite filtration

You can now double the potable water capacity available to your growing community and cut the installation cost of new filtration nearly in half. How? Specify diatomite filtration. You'll reduce land and construction costs because diatomite systems need only $\frac{1}{4}$ the housing space of equivalent-capacity sand plants. In fact diatomite systems are so compact, they can sometimes be added to existing plants.

If you're considering water filtration for the first time, it makes good financial sense to go Celite® diatomite all the way. An actual test installation by Johns-Manville has proved that a diatomite filter station can be installed for 45% less than a sand filter station of equal capacity.†

What's more, Celite will usually give better water clarity under comparable conditions. Turbidity is far lower. More suspended solids, including all floc, amoebae and algae, are removed. And a Celite diatomite system is easily operated and maintained by regular municipal water personnel.

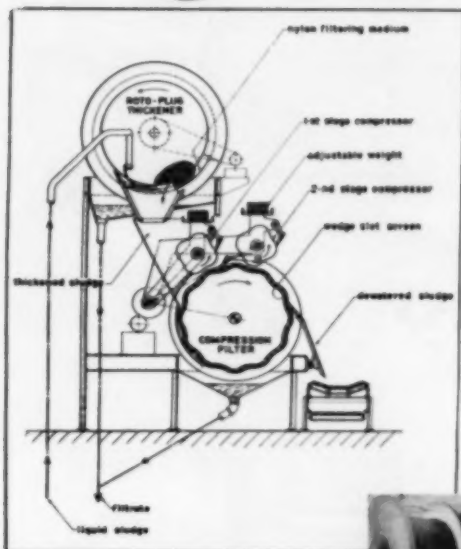
Mined from the world's purest commercially available deposit, Celite is carefully processed for complete uniformity. Call your nearby Celite engineer for complete information on Celite's wide range of grades; he will gladly assist with your particular problems. And write today for **FREE** informative reprint.† Johns-Manville, Box 14, New York 16, New York. In Canada, Port Credit, Ontario.

*Celite is Johns-Manville's registered trade mark for its diatomaceous silica products.
†Comparison Studies of Diatomite and Sand Filtration by G. B. Hill, *Journal American Water Works Association*, September, 1956.

JOHNS-MANVILLE

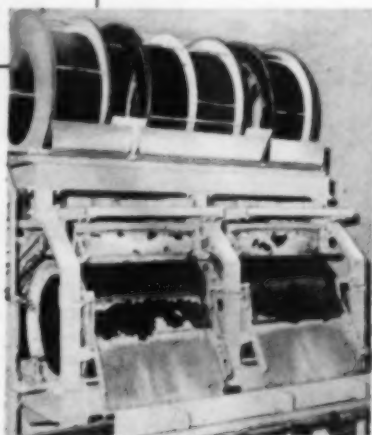


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LOW FIRST COST
LOW OPERATING
COST

AUTOMATIC AND
CONTINUOUS
OPERATION



To dewater sewage and industrial sludge without use of chemicals specify the "Roto-Plug" Sludge Concentrator.

Its use saves the cost of chemicals, chemical handling, storage space. No need for these expensive, hazardous, and hard-to-handle chemicals. And the electrical drives on a "Roto-Plug" that produces 1000 lbs. per hour of sewage solids total only 1 1/4 h.p.

For Full details of the "Roto-Plug" write for Technical Bulletin RP 100. Also write for 24-page Sludge Furnace Bulletin #238.

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air pollution episodes. There are three weather factors which favor the occurrence of the latter: 1) Small dilution due to light winds and a low altitude thermal inversion which inhibits upward mixing, 2) the absence of rain scavenging and 3) the persistence of this weather for several days, permitting pollutants to accumulate. In 1957, an experimental program was established to associate predictions of stagnant warm high pressure systems with measurements of pollutant concentrations. Techniques developed under the program were applied to the eastern United States during September 1 through November 15, 1958. It demonstrated the feasibility of using forecasts of large-scale weather patterns in delineating periods of high air pollution potential. A study of atmospheric radon concentration appears to offer some assistance in determining conditions under which vertical mixing becomes weak.

"Meteorological Aspects of Large Scale Air Pollution." By Lester Machta, Office of Meteorological Research, U. S. Weather Bureau. *Public Health Reports*, April, 1960.

Identifying Organic Acids

While organic acids seldom cause tastes and odors in water, their concentrations may be indicative of the presence of neutral and basic organics. The use of column and paper chromatography for separating and identifying organic acids in water appears to have potential value. An alkaline evaporation of the sample, followed by an ether extraction of the acidified aqueous residue, is used to prepare the sample for the separation of individual acids or groups of acids by using column partition chromatography. The organic acids recovered from water samples from the Ohio and Mississippi Rivers in 1958 ranged from 1,000 to 2,400 p.p.b., 33 to 62 percent of which was attributed to non-volatile components. Comparison of these data with the results of carbon filter sampling for total extractables indicate the relatively high concentration of organic acids in streams. No attempt was made to evaluate the significance of the data as to water potability or toxicity.

"Chromatographic Separation and Identification of Organic Acids—Application to Detection of Organic Acids in River Waters." By H. F. Mueller, T. E. Larson and M. Ferretti, Illinois State Water Survey. *Analytical Chemistry*, May, 1960.

Composting Wood Wastes

The main detrimental factor associated with the use of wood products as soil conditioners is the temporary tie-up of nitrogen from the soil. The degree with which this occurs is related to the decomposition rate of the wood, the least resistant species causing the highest initial nitrogen drain. In this respect Western hemlock sawdust is the most resistant and red alder the least of five species mentioned. Also influencing the rate of decomposition is the size of the organic particle; wood chips are more resistant than sawdust particles. While the nitrogen deficiency can be compensated for by the use of fertilizers, the chief value of woody materials in compost is their influence on physical properties of the soil. Organic additives which can be composted with wood include sewage sludge in the ratio of 1:1 to 1:2, sludge to wood. Of the wood products available as waste for composting the most desirable are chips, shavings and sawdust. Coarse chips and very fine sawdust are not well suited. Bark and pole peelings are all right, if broken down in size.

"Composting Wood Wastes with Other Organic Materials." By Stanley P. Gessel, University of Washington. *Compost Science*, Spring, 1960.

Other Articles

"Treatment Problems Caused by Cucumber Canning Wastes." By Floyd L. Kimball. A plant designed to treat domestic waste plus pickle canning wastes turned anaerobic probably from an unanticipated seasonal overload from the canning industry. *Journal Water Pollution Control Federation*, April, 1960.

"Using Organic Wastes in Agriculture." By S. J. Toth, Rutgers University. The supply of organic industrial wastes in New Jersey is sufficient to dress one-quarter million acres with one ton of organic matter per acre. *Compost Science*, Spring, 1960.

"Investigation and Treatment of Trade Effluents." By F. G. Broughall, R. B. Evans and P. H. Garnet. Methods of treating the effluents of a tar oil refinery and chemical works at Oldbury, Worcestershire are described. *Contractors Record and Municipal Engineering*, March 23, 1960.

Investigations for Cannery Wastes Treatment

Tentative plans to enlarge the existing waste treatment facilities at Boise, Idaho, are reported in "Gas,"

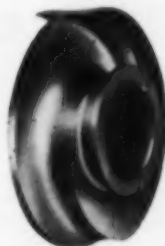
PUBLIC WORKS for June, 1960

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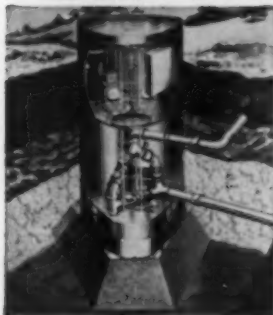


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a publication of the Boise activated sludge plant, A. J. Wahl, Superintendent. In a study made last summer, three methods of treatment were tested experimentally on a small scale for cannery wastes. Findings, plus performance of the facilities now receiving blanching wastes, indicated the use of trickling filters and it is proposed to construct two or more roughing filters approximately 145 ft. in diameter to be used in parallel with the existing filter of the same diameter; two clarifiers; and a chlorine contact tank. A pump station enabling recirculation rates of 1:1 and an additional digester are also proposed.

Treatment of the waste would be accomplished by mixing the industrial waste with domestic primary effluent just prior to introduction to the filter. Mixing the two should provide both seed material from the domestic and food from the industrial wastes. Blancher wastes would still be received in the domestic sewage as has been the custom during the past two seasons.

Volumes of first stage filter effluent up to 7.0 mgd would be treated on a second stage standard rate filter which has shown, in the past, capabilities of almost 70 percent BOD removals and an overall removal of 90 percent through the entire plant. Flows in excess of 7.0 mgd would pass to the new clarifiers and the chlorine contact basin.

This arrangement would give two effluents. One would be discharged to Mill Creek where natural aeration would continue to improve its quality until taken out for irrigation; the other would be ready immediately for irrigation use.

To give an idea as to the volume of waste to be treated, the cannery waste amounts to an average of 4.52 mgd for approximately 40 days. This contains about 22,000 lbs. of BOD per day. Compared with the daily average of 15,000 lbs. (including blancher waste) being received through the domestic system, this represents a very considerable short-time load to treat.

Encephalitis, Highways and Hotels

Last fall there was an outbreak of so-called Eastern Encephalitis in New Jersey. During a 10-day period at the end of September and the beginning of October, toll income on the Garden State Parkway dropped \$60,000, or about \$6,000 per day. During September and October, Atlantic City hotels suffered an estimated \$2,000,000 loss in business.

LETTERS

TO
THE EDITOR



TRENCH WIDTHS FOR PIPE LOADINGS

With reference to my article entitled, "Structural Design of Clay Pipe Sewers," which appeared in *PUBLIC WORKS* for January, 1960, and in reference to the comments made by Leland L. Sphar, Engineer-Manager, Concrete Products Association of Washington, Seattle 99, Washington, which appeared in "Letters to the Editor," *PUBLIC WORKS*, April, 1960, the following information should be considered:

Mr. Sphar brings out several good sewer design points in his letter. I especially appreciate his pointing out the importance of load limitations indicated by the transition width. Trench load tables published by all of the clay pipe manufacturers' associations indicate the transition widths by either (1) actually showing it in feet and inches or (2) by discontinuing the load figures at or near the transition width.

However, I do not hold with the method of determining sanitary sewer pipe loads by applying Marston's projecting conduit formula, mainly because of the difficulty of determining the settlement ratio for a positive projecting conduit. To compute accurately the settlement of the various soil elements and of the conduit by modern soil mechanics methods involves extensive soundings, difficult soil sampling and testing and complicated computations. All this is seldom, if ever, done in designing sewers, as most of us are inclined to use empirical or tentative values of the settlement ratio.

It seems to me that unrealistic pipe load conditions are very likely to result from the use of such empirical or tentative values.

It is for the above reasons that I prefer to determine the loads on sanitary sewers by using the methods set forth in my article.

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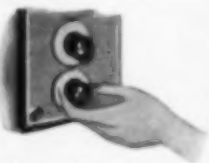
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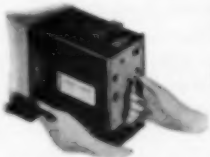
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CURRENT limiting reactors are devices which, when inserted in series with electric power circuits of high capacities, reduce the destructive mechanical forces and the thermal damage which might otherwise be inflicted on circuit breakers, switches, bus supports and other apparatus connected in the circuits. Through their use, fault currents are limited, thus keeping bus voltage drops to the minimum during short circuits and contributing to the continuity of service on unfaulted parts of the system.

By reducing short circuit duty on bus supports, switchgear breakers, and other equipment, reactors provide an economic tool to permit the continued use of existing apparatus in situations in which the power supply capacity must necessarily be increased for system load growth, and permit the use of lower rated (and less expensive) switchgear on newly planned installations.

Reactors may be installed indoors or outdoors. They may be of the open type or totally metal enclosed, and of single phase or three phase construction. In general practice, reactors for service at 34 kv and below are of the dry type, air cooled, or of the oil immersed type. The latter type is used for service above 34 kv. Dry type reactors consist of turns of insulated conductor imbedded in heavy concrete supports designed to withstand the compressive forces that exist during a short circuit. Oil immersed reactors are enclosed in steel tanks complete with transformer-type radiators, cover mounted bushings, and other accessories similar to those furnished with power transformers. Dry type reactors are of the air-core type, while oil-immersed reactors may be of either air-core or iron-core construction.

In the application of current limiting reactors, there are several arrangements which may be used to

provide system protection. Among these are the following:

1. **Generator reactors** are used to introduce additional reactance in the generator leads and thus reduce stresses caused by three phase short circuits. By so doing, they give added protection to the generator, itself, as well as to system equipment supplied by the generator. Sometimes a center-tapped duplex type of reactor is employed for this service which provides high reactance under fault conditions, with low reactance during normal operation. This is accomplished by the direction of the windings in the two halves of the reactor which produce additive fluxes and high reactance when fault currents flow from one generator bus section to the other, but which produce fluxes in opposition when normal currents flow from the generator to the two generator bus sections, thus reducing the effective reactance between the generator and each of the buses.

2. **Neutral grounding reactors**, installed in the neutral leads of generators, limit the flow of current during line to ground fault conditions without affecting operations during normal conditions. Air-core reactors are better for this service due to the absence of higher harmonics which might be produced in the iron of an iron-core type of reactor. In order to limit maximum transient voltages in the neutral of the generator windings, grounding reactors are equipped with special shunt resistors which offer high resistance to normal voltages across the reactor, and low resistance to high voltages during fault conditions.

3. **Feeder reactors** are generally installed in outgoing feeder circuits from a high capacity bus, to limit fault currents and permit the use of lighter duty feeder equipment. They also reduce the stress and voltage drop on the supply bus during short circuits on the feeder circuit, and contribute to the selectivity of the feeder relay protective system.

4. **Bus tie reactors**, inserted between two or more sections of switchgear buses, are used to local-

ize troubles occurring on or between bus sections, to reduce fault currents and mechanical stresses on the buses and associated equipment, and to limit fault current contributions to a faulted bus from power sources on adjacent buses. When a switchgear bus system is expanded, a new bus section of high capacity may be established to supply additional loads, without exceeding the capacity of the existing bus section, provided a suitably rated bus tie reactor is installed between the new and the existing bus sections.

In certain cases, outgoing feeders from each of two bus sections are paralleled by interconnection at a common outlying point in the distribution system. In such cases, the selection of a bus tie reactor, to connect the two bus sections in the plant or substation, must take into consideration the shunting effect on the tie reactor of the externally paralleled feeders.

Other uses for series reactors include equalizing reactors, for installation in the leads from a low reactance transformer to permit its operation in parallel with another transformer of higher inherent reactance; and starting reactors to limit system disturbance caused by starting large motors.

In general, the power losses in current limiting reactors are small, amounting to only a fraction of one percent of the circuit rating in which they are installed. For example, the losses in a standard 4 kv dry type reactor rated 5 percent at 400 amperes amount to approximately 1600 watts per phase, which is equivalent to only 0.2 percent, more or less, of the primary circuit rating. The percentage losses of reactors decrease as their size increases.

In order to protect against forces acting between reactors under fault conditions, it is necessary that they be properly mounted and securely braced. Single phase air-core reactors may be installed with their axes coincidental or parallel, depending on space available for the three phase reactor grouping. In all cases, reactor installations should

be made in conformance with the recommendations of the manufacturer with regard to horizontal and vertical distances between reactor centers, and with regard to top, bottom, and side clearances from magnetic material such as reinforcing steel in concrete floors and walls, and building structural steel. These clearances are provided by the manufacturer in the case of factory assembled, metal enclosed reactors, and reactors of the oil-immersed type.

In any given electric system for which additional power supply capacity is contemplated, it is suggested that consideration be given, if necessary, to the possible use of current limiting reactors as an economic means to permit the continued use of existing switchgear as well as to reduce the required ratings and resultant cost of new equipment needed for the expansion program.

• • •

Acreage Water Consumption

The Helix Irrigation District in San Diego Co., Calif., served an acreage of 30,909 in 1959, with a population density of 3.2 persons per acre. Water use averaged 152 gallons per capita per day or 486 gallons per day per acre of area served. In 1957, when water was in short supply and a "save water" campaign was in effect, usage was 445 gallons per acre per day; and in 1956 it was 481 gallons. Population per acre in 1957 was 2.89 and in 1956 it was 2.60.

• • •

Urban Renewal and Redevelopment Program

The new program in Urban Renewal and Redevelopment at the Graduate School of Public and International Affairs of the University of Pittsburgh is represented by seven student members from Boston, Philadelphia, Seattle, Buenos Aires, Erie and Pittsburgh. These students in the Master's degree program are enrolled in courses which cover political and administrative processes, program development, urban problems and the application of management techniques. A central focus of their program is a workshop which meets four hours each week. The emphasis during the Fall trimester was on urban renewal as a concept and process, and the problems of community organization for effective urban renewal. The stress

in the trimester which began in January has been upon the actual step-by-step planning and implementation of redevelopment and rehabilitation programs.

In addition, each student puts in fifteen hours per week on a research project with a local urban renewal agency. The metropolitan area of Pittsburgh provides an excellent working laboratory. Within the immediate vicinity of the School there are eleven communities embarked on twenty-five renewal projects. They range in size from a small township to the city of Pittsburgh.

Students observe and work on actual projects in these communities and agency directors have expressed great satisfaction with their work.

Faculty members in charge of this include: Robert L. Brown who was city manager of Sherman, Texas, and assistant city manager of Lubbock and San Antonio, Texas; John H. Romani, recently an associate director of Cleveland Metropolitan Services Commission; and Leo Stern, executive director of the Allegheny County Urban Redevelopment Authority.

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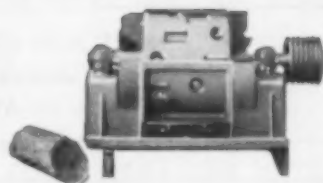


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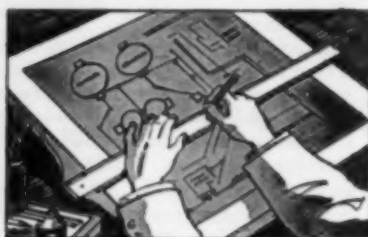
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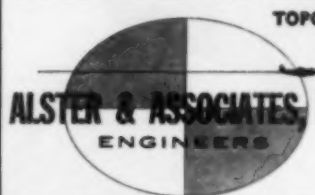
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The cost of laying water mains in Rapid City, S. D., has been reported to us by L. P. Steiling, Water Superintendent, as follows: For six lines of 6-inch, totalling 3,187 ft., \$3.28 per foot, including all fittings, hydrants and valves. The six lines varied in length from 428 ft. to 643 ft. An extension of an 8-in. mechanical joint main 396 ft. long cost \$3.24 per ft.; in addition, there was one 8" x 6" cross at \$49; two 5-ft. valve boxes at \$13.50 each; and two 8-in. gate valves at \$88.29 each. There was no cost to the city for laying the pipe; property owners paid the contractor 80 cents per foot.

A line of 6-in. slip-on cast iron pipe 430 ft. long cost a total of \$1556.15. The pipe cost \$2.11 per ft.; also involved were one one-sixteenth bend at \$18; two 5-ft. valve boxes at \$13.50 each; one 6-inch gate valve at \$56.93; one hydrant at \$236.50; trucking expense, \$15; trenching expense \$86; backfill expense, \$43; 82 hours of labor at \$1.85; and 8 hrs. backhoe operator from the street department at \$1.84. The overall cost was \$3.62 per foot.

• • •

Small Dams

(Continued from page 99)

formula used to compute the tons of sediment deposited in the sediment pool of watersheds in the deep loess area of northwest Iowa is given in Exhibit 2.

The inlet is a 3-ft. by 3-ft. box, 7 feet deep. The outlet is of the cantilever type. The drop through the structure is 19 feet.

Materials and work required for construction: 43,720 cu. yds. compacted fill; 5,450 cu. yds. excavation; 150 lin. ft. 24" reinforced concrete pipe; 24 lin. ft. 24" corrugated metal pipe; 62 lin. ft. 6" perforated corrugated metal pipe; 65 lin. ft. 6" non-perforated corrugated metal pipe; 156 cu. yds. filter material, mixed sand and gravel; and 37 cu. yds. reinforced concrete.

For a Drop Spillway. A typical drop spillway structure is located seven miles southwest of Mapleton, Iowa, in the Phillips subwatershed. The total drainage area is 1,393 acres, 1,195 acres are controlled and 198 acres are uncontrolled. Peak inflow from the controlled area is 507 cfs and from the uncontrolled area is 300 cfs. The total peak inflow from a 50-year storm is 807 cfs.

The inlet is a trapezoidal weir box inlet. Effective length of weir is 43.2 feet. The depth is 4 feet. The drop through the structure is 7 feet.

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For a Chute Type Spillway. A typical chute type spillway is located in the Davis subwatershed three miles southwest of Smithland, Iowa. The drainage area is 90 acres. The estimated peak inflow from a 50-year storm is 230 cfs.

The inlet is a trapezoidal weir box inlet. Effective length of weir is 19.4 ft. The depth is 3.0 feet. The channel is 6 feet wide and the side-walls are 4 feet high. The drop through the structure is 48 feet.

Materials and work required for construction: 10,800 cu. yds. compacted fill; 860 cu. yds. excavation; 89.3 cu. yds. reinforced concrete; 114 lin. ft. 6" perforated corrugated metal pipe; 19 lin. ft. 6" non-perforated corrugated metal pipe; and 70 cu. yds. filter material mixed sand and gravel.

• • •

Channel Problems

(Continued from page 115)

in depth and increase in velocity can extend with considerable magnitude far upstream, maybe to the next drop.

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PUBLIC WORKS EQUIPMENT NEWS



Quickly attached backhoe unit specifically designed for Michigan tractor shovels.

Backhoe Attachment

This fully hydraulic backhoe can be snapped on or off a tractor shovel in less than a minute without tools, according to the manufacturer. Features include 180 degree continuous swing, 180 degree bucket tilt, 12 ft. 4 in. digging depth, 10,000 pound breakaway at the bucket teeth, and 15 ft. 6 in. reach from center rotation. Designed specific-

ally for use on the Michigan line of tractor shovels, the backhoe will take a variety of buckets. These snap on and off in half a minute or less.

Construction Machinery Div.,
Clark Equipment Co., Pipestone
Rd., Benton Harbor, Mich.

Circle No. 6-1 on the convenient
reply card facing page 34.

Fire Hydrant Meter

The Sparling Fire Hydrant Meter provides a method of measuring exact quantities of flow during any temporary delivery from the hydrant. Total flows from 30 gpm up are registered on a straight-reading totalizer at the meter. Accuracy is within 2%. Propeller is polythene. Pressure drop is less than one psi at 200 gpm. The entire meter weighs only 23 pounds and has double handles for easy carrying and handling. Standard hose and hydrant couplings at both ends.

Hersey-Sparling Meter Co., 225
N. Temple City Blvd., El Monte,
Calif.

Circle No. 6-2 on the convenient
reply card facing page 34.

Liquid Crack Sealer

A rubberized liquid sealer for cracks in asphalt and concrete pavements, Lastek 33, is said to prevent water penetration and subsequent freeze-thaw damage. It is satin black in color, closely resembling Jennite J-16 surface sealer with which it is frequently used. Lastek 33 is recommended for use in all cracks less than $\frac{3}{8}$ inch wide. It is applied by pouring from small nozzle cans or cones. Packaged in 1 qt. plastic squeeze bottles for easy use, it is also available in 5 gallon cans. A table shows the quantity of material required.

Maintenance, Inc., Wooster, Ohio.

Circle No. 6-3 on the convenient
reply card facing page 34.

Concrete Grinder

A new concrete slab grinder, Model JR, is powered by a $\frac{3}{4}$ HP, 110/220 volt a.c. motor. Counter-rotating twin discs in neoprene mountings provide torque-free operation. The unit weighs less than 100 pounds and has a grinding area of 112 sq. in. It employs six 1x2x3 grinding stones, and features the "Pelican Pak" which provides easy storage for grinding stones. The overall height is 37", width 15" and an overall length of 19 $\frac{1}{2}$ ".

Equipment Development Co., 2700
Garfield Ave., Silver Spring, Maryland.

Circle No. 6-4 on the convenient
reply card facing page 34.

Curbing Machine

A heavy-duty line of Stephens-Canfield Curbing Machines that lay concrete or asphalt curbs by the extrusion method features components in the power train which permit the laying of curb at speeds of up to 12 feet per minute. There is a removable hopper for easy maintenance, and a new "no stress" auger or compaction screw. There are no forms to be placed or stripped, because this machine extrudes either asphalt or concrete curb in its final shape. A relatively dry portland cement concrete mix of "zero slump" or a dense asphalt mix is used.

Power Curbers, Inc., P.O. Box
1465, Salisbury, North Carolina.

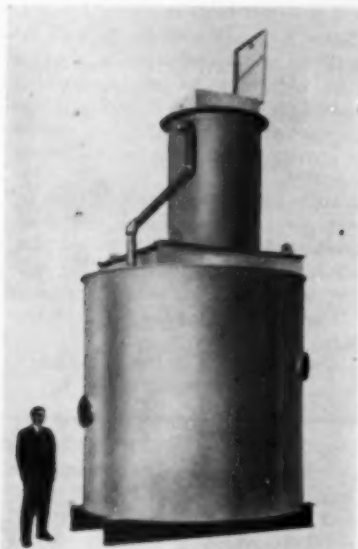
Circle No. 6-5 on the convenient
reply card facing page 34.



Extruder for asphalt or concrete curbs.

Prefabricated Sewage Pumping Station

Komline-Sanderson Engineering Corporation is offering a factory assembled, welded steel, prefabricated sewage pumping station incorporating either pneumatic sewage ejectors or standard sewage pumps. The stations are fabricated of $\frac{3}{8}$ "-thick steel for the wall sections and $\frac{1}{2}$ " for top and bottom plates. Over-all stations include access ladders, balanced hinged doors, lights, dehumidifier, blower and sump pumps. In ejector stations, heavy-duty cast iron pots are utilized with either electrode or



pneumatically operated liquid level controls. Welded steel ejector electrode controlled pots are integrally fabricated with the steel shell of the station in either single or duplex types. Separate air receivers are utilized when required. Ejector stations including two pots as large as 300-gallon capacity have been manufactured. Pumping stations incorporate vertical "non-clog" centrifugal pumps having gland seals and bubbler-type control systems for the adjacent wet well. The station walls are coated with epoxy resins. Special electric control panels, spring-loaded check valves and inlet and discharge pipe connections extending outside are standard items. Stations as high as 19' have been manufactured and shipped in one piece to job sites.

Komline-Sanderson Engineering Corp., Peapack, New Jersey.

Circle No. 6-6 on the convenient reply card facing page 34.

Utility Tractors

Three new series wheel and crawler tractors with new and higher-capacity companion power equipment are featured in the 1960 Case Utility line. The 530 Utility wheel tractor is powered by 47 hp high-torque Case gasoline engine, has 90% assist power-steer and synchronized shuttle transmission for easy maneuvering and fast loading cycles. Shuttle transmission provides travel speed of 18 mph, 8 speeds forward, 8 reverse, with back-up 24% faster than forward in each gear. The backhoe for Model 530 (and Model 310D crawler) cuts 14' deep, digs 16' 9" from pivot, and operates through 180° arc. The economy Model 430 Utility wheel tractor is basically the same as the 530 but is a lower-priced unit with a 38.5 hp gasoline engine, and 4-speeds forward, one reverse as standard equipment. The 310D Utility crawler tractor gives 5815 lbs. pull and push-power for use as a loader, bulldozer, angling dozer, loader-backhoe, or drawbar unit.



Model 530 Case Utility backhoe-loader.

The 310D loader, equipped with $\frac{3}{4}$ -yd. bucket, applies 7000 lbs. break-away force, lifts 3500 lbs. to full height. The Bulldozer and Angling Dozer push-arms are outside the track.

Circle No. 6-7 on the convenient reply card facing page 34.

Container System

A sanitary, slightly and simple operation—the "container system"—is available through the use of modern packer-type trucks equipped to handle the Hobbs Hyd-Pak Container System. Placed at each customer's place of business are one or more $1\frac{1}{4}$ -cu. yd. or 2-cu. yd. heavy, white enamelled steel containers with built-on brackets for hand-

ling by the mechanical lift. Users say that the containers reduce general labor costs by at least 50 percent. Under favorable conditions the container-equipped truck can service up to 90 containers per day, depending on how many are at each stop and how far apart the stops are.

Hyd-Pak Div., Hobbs Trailer Co., 609 No. Main St., Fort Worth 6, Texas.

Circle No. 6-8 on the convenient reply card facing page 34.



Hobbs container system of refuse collection features a hydraulic container lift.

Front-End Loader



Loader has 4-wheel drive and carrying capacity of 4,000 lbs.

This four-wheel drive loader has a carrying capacity of 4,000-lbs. and a static lifting capacity of 9,500-lbs. The TL-12 has the power-reversing Tractomatic transmission with a lever on the steering column to control both forward and reverse movement without stopping the machine to clutch and shift gears. Four speeds forward are provided to 21.2 mph, and four reverse speeds to 27.9 mph. The TL-12 is available with either A-C 77-hp gasoline or 76.5-hp diesel engines. Four buckets are available, ranging from 1 to 2 cu. yd. capacities. Bucket tip-back at carrying height is 47 degrees, and

there is up to 14,500 lbs. of breakout force at the cutting edge. Maximum dumping clearance under the cutting edge is 8 ft. 4 in.; under the hinge pin it is 10 ft. 3 in. At maximum dumping height, reach from the front of the tires to the cutting edge is 2 ft. 8½ in. Turning radius is 19 ft. 5 in. with the bucket in carry position. Power steering and four-wheel hydraulic power-boosted brakes are standard equipment. Optional equipment is available.

Allis-Chalmers Manufacturing Co., Milwaukee, Wisconsin.

Circle No. 6-9 on the convenient reply card facing page 34.

Tandem Roller



Hugging walls and curbs and making sharp turns are features.

A 4-6-ton tandem roller features ability to work within ¾ inch of building and foundation lines, extra high clearance of curbs, turning radius of only 14½ ft. extra width of compaction roll and low center of gravity. Finger-tip control power steering, unexcelled visibility, hydraulic brakes and simple forward and reverse transmission, are other important features. It is an ideal machine for jobs that defy big rollers yet demand big roller treatment.

General Engines Co., Inc., Thoro-fare, N. J.

Circle No. 6-10 on the convenient reply card facing page 34.

Ventilating Heater

An improved ventilating heater for manhole and other underground use is the MoPeCo Model PE-G, a 78 pound portable ventilator and heater with attached 300-watt generator. The Briggs & Stratton engine has been converted to propane carburetion. The heated air (from

300 to 800 cubic feet per minute) passes through the heat exchanger and all products of combustion pass into the atmosphere through the burner exhaust so that only safe fresh, heated air is forced into the manhole area. The forced draft burner has an input rating of from 10,000 to 45,000 BTU's per minute with 98° temperature rise. It is designed for year round ventilation, delivering heated fresh air in winter and fresh air only in summer when operated as a blower. A 62-pound Model PE is identical less the generator.

Morrison-Pelsue Co., 2001 So. Bannock St., Denver 23, Colo.

Circle No. 6-11 on the convenient reply card facing page 34.

Contractor's and Builder's Transit

This transit has an internal focusing, 24 power, erecting telescope that can be plunged between standards for back sights. It has vertical and horizontal circles, engine divided on a new tarnish proof metal. Both can be read to single minutes

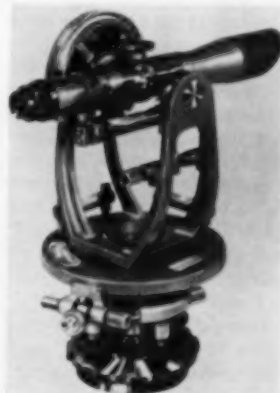
with double verniers. It has clamp and tangent screws for both the center and the horizontal circles as well as the telescope. Furnished complete with wide-frame tripod in hardwood carrying case and accessories.

Warren-Knight Co., 136 N. 12th St., Philadelphia 7, Pa., and ask for Bulletin No. PW 32.

Circle No. 6-12 on the convenient reply card facing page 34.



Use of heat exchanger assures fresh hot air and unit drives 300-watt generator.



Transit for builders' use has 24-power erecting telescope.



Power Shift Transmission

A Traxcavator, featuring a power shift transmission, the 955 Series H, a 100-net horsepower machine, is powered by a turbocharged four cylinder diesel engine. Bucket size has been increased from 1½ cu. yd. to 1¾ cu. yd. Four work speeds are available to the operator. Steer-

ing clutch lever, parking brakes, in-seat starting controls, throttles and the compression release are mounted on the same column. The operator's seat is adjustable, with four vertical and three forward positions available. Retained features on the 955H include automatic

bucket positioner and kickout, 40 degree tilt back and 47½ degree tilt at maximum lift, three grouser track shoes and hydraulic track adjusters. Dumping height is 130 inches, with a dumping reach of 41.2 inches at a 45 degree discharge angle. Attachments include side-dump bucket, light material bucket (2¾ cu. yd. capacity), a skeleton rock bucket, a heavy material bucket, a quarry bucket, bulldozer blade, bucket teeth, counterweight, ripper, pulpwood fork, lumber fork, log fork and top clamps for log fork.

Caterpillar Tractor Co., Peoria, Illinois.

Circle No. 6-13 on the convenient reply card facing page 34.

Service-Utility Bodies

Seven new service-utility bodies designed specifically for International light-duty trucks are available in four conventional and three completely-enclosed models all having heavy-duty corrugated steel floors, full-length drip mouldings, completely-enclosed wheel housings and double-panel, electrically-welded steel compartment doors. All bodies offer 48½ inches of unobstructed space between compartment sides. Conventional models are available in 79, 82½, 89 and 100-inch lengths; enclosed models, with locking double rear doors, in 82½, 89 and 100-inch lengths. The 82½ inch bodies are designed for the International Travelette, with six-man cab. Optional equipment includes overhead rack with adjustable ladder and material brackets, telescopic steel roof with locking endgate, side-mounted pipe carrying brackets, heavy-duty rear bumper with safety-tread step and removable vise and pipe threader bracket.

International Harvester Company, 180 N. Michigan Ave., Chicago 1, Ill.

Circle No. 6-15 on the convenient reply card facing page 34.

Highway Marker

A self-propelled, one-man operated striping machine, the Master 10, is offered by the M-B Corporation. Key feature is the width which is only 50" overall. Designed for usage on state highways, county roads and city streets, the machine lays one, two, or three lines 3" to 6" wide, in one or two colors. Lines may be painted solid or intermittent with skip line attachment for automatic gun control. Fast operation is assured with 3 speeds forward, up to 10 mph, plus reverse. Automotive type steering on two front wheels enables precision marking for new stripes and retracing of old lines. Features include 21.5-hp engine; 55 CF displacement compressor; fold-

ing "A" frame steering guide; automatic, air operated Binks paint guns; large 180-square inch strainer screen for each tank; and Model T6 Timer which provides independently adjustable cycles to paint guns and dispensers insuring synchronization of beads and paint on skip lines. The unit carries two 60-gallon paint tanks or one 120-gallon tank. M-B Bead Dispenser with 360 lbs. capacity bead tank is available for reflectorized stripes. An M-B low-bed, tilt-type, two-ton capacity transport trailer provides for moves.

M-B Corporation, New Holstein, Wisconsin.

Circle No. 6-14 on the convenient reply card facing page 34.



Striper paints up to three lines and 3 to 6 inches in width.



International B-100 truck with 89-inch service-utility body.



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for...**



**ROBERTS FILTER
MANUFACTURING CO.**
640 COLUMBIA AVE.
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PARKING
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DETROIT, MICHIGAN**

Harry E. Paulsen, Gen. Mgr.

Box and Valve Locator

The Model 620T box and valve locator locates valves, manhole covers, valve risers, corner monuments, meters, curb boxes, and other metallic masses that may be concealed or underground. Features include a transistorized receiver packaged in a lightweight aluminum box, precision-wound detection loops. A transistorized oscillator is contained within the detection head. A single tuning control makes it simple for an inexperienced operator to adjust the instrument. The entire unit, compactly housed in a handy carrying case, consists of amplifier box, carrying handle, detection head, earphones and operating instructions.

The Goldak Co., Inc., 1544 West Glenoaks Blvd., Glendale, Calif.

Circle No. 6-16 on the convenient reply card facing page 34.



Detector for concealed metallic objects.

Butterfly Valve

For flow applications where positive, drop-tight shut off and/or resistance to corrosion are important requisites, the new Rockwell butterfly valve is small in overall dimensions and light weight. An 8" butterfly valve is 2½" face-to-face, 8¾" from center line of pipe to top of valve and weighs 37.5 lbs. The disc travels from full open to full closed position in only a quarter of a revolution. There are no mating metal surfaces and no voids or cavities in the valve body to cause eddy currents or fouling with foreign matter. Pressure drop is extremely



Butterfly valve with replaceable liner.

low. The disc seats against the liner of molded rubber or synthetic elastomers. This liner is replaceable on the job. This assembly is designed to withstand water hammer, hydraulic shock and vibration several times the rated load. The valve operating mechanism, manual or automatic, is secured to the shaft by a shear pin. The valve components are made of any desired combination of metals. Available sizes—2" to 36", and in both 50-lb. and 150-lb. pressure ratings.

W. S. Rockwell Co., Fairfield, Conn.

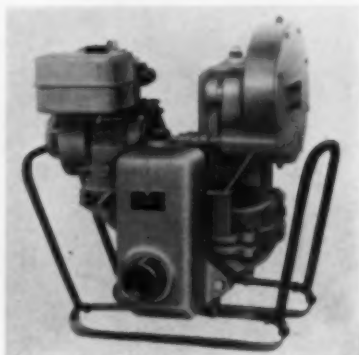
Circle No. 6-17 on the convenient reply card facing page 34.

Diaphragm Pump

This diaphragm pump with 3-in. connections and a capacity rating of 4,300 gph is equipped with a 3 hp gasoline engine. Constructed of aluminum alloy, with shafts and gears of special material to withstand wear, pumps are mounted on vibration-proof spring skids. Also available with 1½ hp electric motors, these pumps are equipped with suction and discharge air chambers which eliminate "jerking" of suction hose and produce smooth flow from discharge lines.

Midland Products Co., Route Seventeen, Mahwah, N. J.

Circle No. 6-18 on the convenient reply card facing page 34.



PUBLIC WORKS for June, 1960

Refuse Body

A refuse body holding over 16 cu. yds. has been designed to fit a 2-ton truck chassis. Wearing parts are stock items and easily available. All models are equipped with interchangeable container attachments. The compaction blade increases the payload. Containers are built 22 inches from the ground and ball-bearing casters make it easy to move them from varying dock heights or even below ground level. Load opens upper doors as it is unloaded. The loading bucket cycles from a convenient loading height to dump and back in less than 20 seconds and is under control of the operator at all times.

Collins Associates, Inc., Box 38, Cincinnati 11, Ohio.

Circle No. 6-19 on the convenient reply card facing page 34.



Body combines low lift, light weight.

Hydraulic Mower

A hydraulically operated highway mower with adjustable knife speed is available for mounting on most industrial tractors. The knife speed is maintained when changing the height or angle of the cutter bar. By moving a single control, the cutter bar height can be changed from ground level to 15 inches or more, and the cutter bar remains horizontal while being raised. A second control enables the operator to change the cutter bar for mowing at any angle from 90° above to a full 45° below tractor level. If the cutter bar strikes a rigid obstruction, the breakaway latch permits the cutter bar to swing back and clear automatically. The cutter bar is re-engaged by lowering the outer shoe when the tractor backs up. The operator can free a jam up by reversing the hydraulic motor.

A. C. Anderson, Inc., Department 162, Wildwood, N. J.

Circle No. 6-20 on the convenient reply card facing page 34.

Vibratory Screed

This vibratory screed is designed to handle stiff, harsh concrete mixes. The screed, ideal for industrial floors, bridge slabs and small road jobs, is available in 8, 10, or 12 ft. widths, and is powered by a gasoline or an electric motor.

Vibro-Plus Products, Inc., Stanhope, New Jersey.

Circle No. 6-21 on the convenient reply card facing page 34.



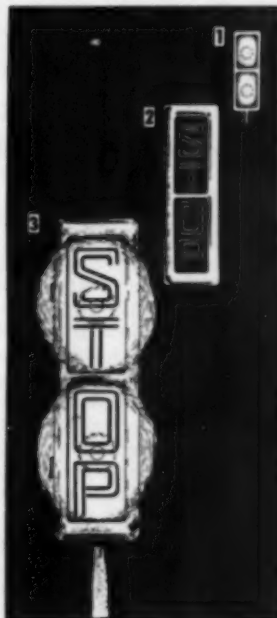
Screed eases the handling of stiff mixes.

Electronic Warning Signs

A line of warning lights combines electronic flashing lights with neon letters. The electronic flash tubes mounted in large reflectors flash on and off, emitting intense bursts of white light, while the neon letters spell out a continuous warning. "Surgelites" are made for toll gates, railroad crossings, bridges, airports, etc. They can be made in any size, with any message, and any number of flash tubes.

Electronic Lights, 1713 N. Ashland Ave., Chicago 22, Ill.

Circle No. 6-22 on the convenient reply card facing page 34.



STABILIZE UNPAVED ROADS KEEP DUST DOWN . . .



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End the wasteful dust plague—complaints, too! Keep road surfaces intact; minimize gravel losses, blading costs! Dow calcium chloride stabilizes unpaved areas by absorbing, then holding moisture. Two types, pellet or flake . . . more economical in bulk.

Write for literature kit on unpaved roads.



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Consider these features

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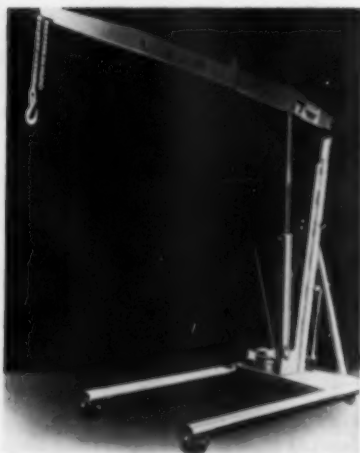
351 Jefferson, Dallas, Texas
Tel.: WHitehall 1-5707

PRELOAD CONCRETE
STRUCTURES INC.
837 Old Country Road
Westbury, L. I. N. Y.
Tel.: EDgewood 3-4040

THE CANADA GUNITE
COMPANY, LTD.
125 Hymus Boulevard
Pte Claire, P. Q. Can.
Tel.: OXford 6-6772

HERRICK IRON WORKS
28400 Claviter Road, Hayward, Calif.
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Hydraulic Crane



A manually-operated 1-ton capacity hydraulic floor and truck crane features lightweight high-strength construction and 2-speed hydraulic control valves. Four models of floor cranes, including a convertible floor-truck unit, and one truck or pedestal-base model are available. The adjustable control valve provides both fast lifting speeds with light loads and extra power for lifting of heavy loads with fingertip control and positive holding action. Maximum effort to lift heaviest loads never exceeds 50 lbs. In addition, a factory pre-set overload relief feature assures safety and protection for operators, loads and the equipment. A complete line of accessories can be supplied as optional equipment.

Ruger Equipment Inc., 206 West Fourth St., Uhrichsville, Ohio.

Circle No. 6-23 on the convenient reply card facing page 34.

Camera-Projector

A new camera-projector, utilizing both 105 mm and 35 mm film, provides a high production rate with first-quality negatives and blow-backs of original drawings. The automatic filter in the optical system modifies light from that suitable for hard-line projection to the soft light needed for continuous tones. Red image projection for accurate positioning and registration is another feature which simplifies the production of prints. The holding of 35 mm roll film in vacuum during filming and projection exposure makes possible enlargement of the sharpest, cleanest negative.

Keuffel & Esser Co., Third and Adams Streets, Hoboken, N. J.

Circle No. 6-24 on the convenient reply card facing page 34.



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GEN. MGR.

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AIR CONDITIONED
HEATED
SWIMMING POOL
OCEAN BEACH
FREE PARKING - PARK
OWN CAR IF SO DESIRED
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\$6, \$7, \$8, \$9, \$10
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1 or 2 persons
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100% AIR CONDITIONED



Miami Beach

74th STREET
on the OCEAN

Florida

Tamping Roller

Tamping wheels designed to increase earth compaction speed are features of the new Model D tamping roller of the Hyster Company. There are two compaction wheels, each equipped with tamping feet of tough alloy steel. Designed to operate at peak effectiveness up to 15 miles per hour, the tamping wheels will achieve almost complete "walk out," leaving a smooth fill surface for faster operation of hauling units. Because of its ability to work at higher speeds, the roller is most productive when towed by the Caterpillar DW15 or DW20 tractor. Standard wheel arrangement includes two drums which provide a rolling width of six feet.

Hyster Company, P. O. Box 328, Peoria, Ill.

Circle No. 6-25 on the convenient reply card facing page 34.

Aerial Ladders



Ladders are available in lengths of 29', 32' 9" and 36' 8" for mounting on trucks, and up to 80' for in-plant or special use on portable bases. Flexibility in use of the pedestal-base ladders permits inclinations of 72° and a full rotational sweep of 360°. Other features include collapsible platform, semi-automatic operation, structural steel frame.

Industrial Systems Co., 30 Main St., Matawan, New Jersey.

Circle No. 6-26 on the convenient reply card facing page 34.

Vacuum Filter



No. 1

This is a horizontal, continuous vacuum filter which uses a new type of vacuum seal with no movable valves and a corrosion resistant, sectionalized drainage belt which permits close separation of filtrates. The entire filtration cycle from feed to filter cake discharge is visible for maximum operating efficiency. Among the suggested uses: Chemical processing, sewage treatment, concentration of ores, filtering slurries, food processing, and in the pulp and paper industry. Down time is reduced because the filter media can be removed and replaced in 30 minutes. The filter cake is formed by a combination of vacuum and gravity drainage and is discharged by gravity.

Straight Line Filters, Inc., Box 291, Wilmington 99, Del.

Circle No. 6-27 on the convenient reply card facing page 34.

Self-Priming Pumps

Pacific Mercury centrifugal self-priming pumps are made in two carryable models that are so light they can be carried with one hand. Special design eliminates the check valve and peeler, yet the pump primes very fast. Both models, the 5M and 7M, have four-cycle engines with automatic recoil starter, oil bath air cleaner, suction strainer, shock-absorbing rubber mounts, convenient carrying handle, replaceable wear plate and iron volute, and a patented impeller design that keeps the seal free of debris.

Pacific Mercury, 13232 Leadwell, North Hollywood 9, Calif.

Circle No. 6-28 on the convenient reply card facing page 34.

CLASSIFIED ADVERTISING

Experienced Engineer Administrator Available

A professional engineer with heavy administrative experience desires to reassociate in a career position with broad opportunities. Possessing impeccable references in support of his qualifications, he is an A.T.R. pilot, has a substantial background in military and civilian aviation, has a proved record of advancement in the coordination and supervision of the design and construction of major public works projects and, at the age of 41, is particularly qualified in engineering contract administration.

For complete Resume, Write to:

Box 6-2

PUBLIC WORKS Magazine
200 South Broad St.
Ridgewood, N. J.

TECHNICAL

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Selected, pertinent, current references in the water, sewage, industrial waste and swimming pool fields. The service includes:

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For progressive laboratory in the Lake Michigan area doing sewage, industrial waste, and water quality analyses. Degree not essential. A good opportunity for the right man. Send résumé, including salary requirements to:

Box 6-1

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City Engineer Available

A highly qualified engineer who has served a city engineer for a good-sized city in the Middle West desires to relocate. Known to and recommended by the Editor of Public Works, he has had broad engineering experience, as a city engineer, in engineering practice and as an Army officer in World War II. Fuller details on training and experience on request.

Write to:

Box P-5

Public Works Magazine
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Sanitary Engineer

Salary open. Sewer and sewage plant design experience and water quality knowledge. Permanent position with consulting engineer.

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Pasadena, California

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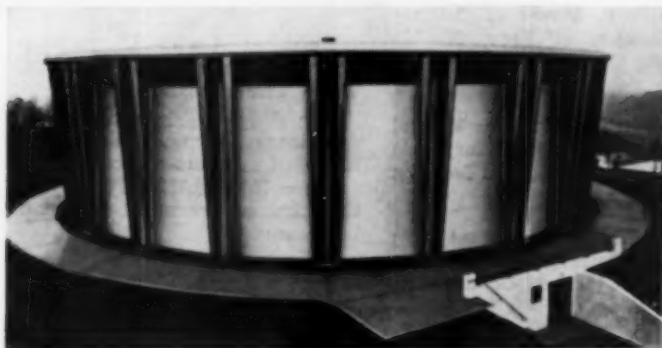
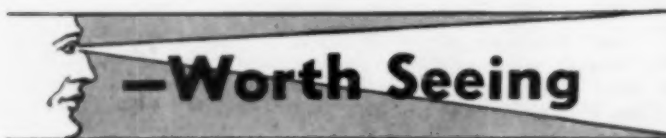
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Better lighting is promised for this highway interchange north of Milwaukee, Wisc., where a total of 116,000 ft. of aluminum cable was installed to serve nearly 300 mercury vapor luminaires. The cable, supplied by Kaiser Aluminum & Chemical Sales, Inc., is direct buried to provide an economical yet permanent power circuit for the new system.



Answering opponents of above-ground reservoirs near prime residential areas, this 5 million gallon tank erected by Pittsburgh-Des Moines Steel Co. presents an attractive curved roof cornice connected to 24 vertical pilasters. Structure is painted in pleasing shades of blue.



If anyone says highway guardrails are unnecessary, show him this picture! Taken on the Southeast Expressway in Boston, it portrays what happened when a truck tractor and its trailer parted company. The Armco Steel guardrail prevented a major wreck and traffic tie-up.



Chlorination of water flowing through this 60-in. reservoir discharge line in San Francisco is paced by a giant Sparling saddle meter. Propeller blades are of polyethylene.

Believed to be the biggest vehicle of its kind ever produced, this 75-ton twin-engine earthmover built by International Harvester is getting its on-the-job tests. Machine is essentially two 2-wheel tractors, joined back to back, powered by two 375-hp International diesel engines. Top speed is 21 mph.





YOU'RE LOOKING DOWN THE TEETH OF A VERMEER POW-R-DITCHER

From whatever angle you look at it, you'll recognize the big, powerful ditcher that can solve most of your trenching and ditching problems . . . the model 524T Vermeer POW-R-DITCHER. Unit above is digging water main ditch on a large construction project at Lexington, Ky. Ruggedly built to handle the toughest jobs, the POW-R-DITCHER is ideal for municipalities, contractors, utility companies and institutions.

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The Self-Propelled POW-R-DITCHER digs at variable speeds, 8 to 24 inches wide and down to 6 feet deep. The 524T POW-R-DITCHER is a one-man operated, highly maneuverable unit. Large two-way conveyor deposits dirt on either side of ditch. Has hydraulically controlled steering with separate steering lever for each crawler track. Especially designed for digging wide foundation footings, gas, water and sewage lines. Low in price . . . low in maintenance cost.

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by Arthur K. Akers

★ **William G. Hetrick**, Bowling Green, Ohio, becomes assistant advertising and sales promotion manager, Daybrook Hydraulic Division and Ottawa Steel Division.

★ Our old friend **Milt Rosen** of St. Paul got the largest vote for councilman in a recent election out of twelve aspirants.

★ **Griffin Pipe Division**, Council Bluffs, Iowa, appoints **John M. Masterson**, district manager at Denver for Rocky Mountain states sales. He was formerly with Glamorgan Pipe & Foundry Co. in Chicago.

★ **J. K. "Jack" Neubauer** is promoted to general sales manager, Standard Steel Works, Inc., North Kansas City, Mo., makers of road construction machinery.

★ **Ludlow Valve Mfg. Co.** news includes **Alex E. Mason** as assistant sales manager, at Troy, N. Y.; **George K. Console** as New York City area district manager.

★ **Texas Vitrified Pipe Co.**, Mineral Wells, Texas, finds itself forced to build additional production facilities for their clay pipe.

★ **Martin Wank** is promoted from assistant to sales promotion manager, Graver Water Conditioning Co., New York.

★ **A. MacDonald Ferreira** appointed general sales manager, City Tank Corp., Corona, N. Y.

★ All eastern region sales for Bucyrus-Erie Co. will now be under the responsibility of **J. V. S. Norton** as manager.

★ "**Jerry**" **Fleet** is now in association with **James P. Cannon** and moving to 60 East 42nd Street, New York, representing more good Public Works advertisers of water and sewage equipment than we can list here.

★ Mathematician **Joel M. Kibbee** is named manager of customer educational services of Remington Rand Univac Division.

★ **Frank T. Quinn** of Memphis, elected president of Layne & Bowler Inc., Memphis, deep well drillers and pump makers for the world. **John M. Proos** of Indianapolis is new chairman of the board.

★ **Thomas G. Smith**, aged 30, vice president and sales manager, Gordon Smith & Co., compressor manufacturers, of Bowling Green, Ky., died April 4.

★ **Spaulding Norris** is named to new post of vice president in charge of sales, also a director, of Yeomans Brothers Co., Melrose Park, Ill., manufacturers of pumping and waste treatment equipment.

★ **General Electric Co.** signs long-term contract to assume ownership of all two-way radio units now operated by the New York State Police, succeeding the New York Telephone Co. in this capacity.

★ **Ralph B. Carter Co.** appoints **Fritz F. Tentschert**, sales manager, Waste Treatment Division.

★ **Chicago Pump Division** names **William D. Anderson** product manager for **RATEDAERATION** Small Unit Sewage Treatment Processing Equipment.

★ **PUBLIC WORKS Publications' News** includes Associate Editor **Clayton H. Billings** speaking at the Southern Municipal and Industrial Wastes Conference, Raleigh, N.C.; Associate Editor **Lloyd (Gary) Byrd** at Ohio Highway Engineering Conference at Columbus and Purdue University Road School. **Colonel Hardenbergh** is on the new APWA Public Relations Committee and Managing Editor **E. B. Rodie** will serve on the APWA committee to review service fees and privileges to certain membership classes. **Robert J. Shea**, Mid-West sales manager, will speak before various Chicago groups under the sponsorship of the Chicago Federated Advertising Club.

★ No one really needs a mink coat—except a mink.

—Hersey-Sparling Metrogram



FORE!

"Golf Ball on a Tee"

**provides gravity pressure
water storage**

Golfers touring the Oaks Country Club course at Oakhurst, Oklahoma for the first time seldom fail to comment on this striking landmark. It appears to be a giant golf ball perched atop a huge yellow tee.

In reality, it is a CB&I Watersphere. Built for the Tulsa Metropolitan Water Authority, the structure has a capacity of 125,000 gallons and is 97 feet to bottom.

Here is visual proof that elevated water storage tanks can be attractive . . . can actually enhance the surrounding landscape. Most important, of course . . . they provide dependable gravity water pressure for general service and fire protection. Complete information is available from our nearest office. Write today.

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Merely by adding, not adapting, a W&T V-notch Chlorinator can give you any degree of automatic control you want—step rate, start-stop, program, proportional, even residual control.

With a V-notch Chlorinator any signal from any primary metering device can control chlorine feed. So anyone can afford automation.

And, of course, the right plastics make the whole chlorinator chlorine-proof.



A booklet, "The V-notch Story" will tell you about all the W&T V-notch Chlorinator features. For your copy write Dept. S-134.78



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